A. Contractor shall maintain on site a complete, accurate survey log documenting survey work as it progresses.

B. Contractor shall maintain on site a plan clearly showing all site reference points, survey control points, and benchmarks.

C. Contractor shall maintain on site an accurate and current set of marked-up drawings showing "as-built" conditions.

D. As-built surveys, stamped and signed, by a State of Florida Licensed/Registered Land Surveyor or Professional Engineer, shall be submitted immediately following the completion of any applicable construction element. Complete as-built surveys shall be submitted upon substantial completion of each phase of construction and are a prerequisite for contract closeout.

E. Upon completion of each work item, Contractor shall prepare and/or update "as-built" drawings.

PART 2 - PRODUCTS

2.01 MATERIALS AND SURVEY EQUIPMENT

A. Provide materials and survey equipment as required to properly perform the surveys, including, but not limited to, instruments, tapes, rods, measures, mounts, and tripods, stakes and hubs, nails, ribbons, other reference markers, and all else as required.

B. The survey instruments used for this work shall be precise and accurate to meet the needs of the projects. All survey instruments should be capable of reading to a precision of 0.01 ft and with a setting accuracy of ± 0.8 seconds.

PART 3 - EXECUTION

3.01 GENERAL

A. Maintain accurate and complete notes of surveys:

1. Handwritten survey notes and information shall be written with lead pencil(s) and entered in "write in rain" notebooks. A copy of the numbered, dated, and signed field book pages shall be provided to the Engineer as requested for use in checking the work.

2. Electronic field survey information shall be collected and backup equipment shall be available in the event of equipment malfunction.

   a. Electronic format for printed output of data collector field survey notes shall be compatible with the approved fieldbook notation format.

   b. Electronic format for printed output of data collector field work shall be compatible with the Contractor's and Engineer's computer equipment and software for verifying and checking the work. A copy of the data disk shall be submitted to the Engineer as requested.

B. During construction, survey notes shall be retained by the Contractor and shall be submitted to the Engineer for review upon request. Prior to the placement of successive soil or geosynthetic layers the Contractor shall submit a written statement certifying compliance of the preceding layer thickness and grades to the Engineer. Surveys will be required from the Contractor prior to approval by the Engineer for the placement of overlying materials.

C. Conformance check surveys for elevation and for horizontal coordinates shall be to the nearest 0.01 ft and for angles shall be to the nearest 20 seconds.

D. Measurement and payment surveys for elevation and for horizontal distances shall be to the nearest 0.1 ft ± 0.05 ft.

E. Perform construction layout surveys in advance of scheduled construction activities. At completion of a survey, provide a copy of the field notes, drawings, or sketches to the Engineer for review. The Contractor shall allow the CQA Consultant and/or Engineer three calendar days for review. The Contractor is responsible for rework and/or construction delays caused by survey or staking errors.

F. Set slope stakes in accordance with accepted surveying practices.

G. Set grade stakes required for construction activities as the work progresses. Set fine grade stakes on all items for which the plans show a definite grade line.

H. Upon completion of the work, the Contractor shall provide the Engineer with all original surveying field notes, layouts, computations, and electronic files in standard bound survey notebooks. Electronic file information shall be compatible with the Engineer's computer equipment and software as requested.

I. Protect survey control points. Replaced disturbed survey control points at no additional cost to the Owner.

3.02 FIELD REQUIREMENTS

A. Establish temporary control points as necessary to support construction activities.

B. Survey Documentation.

a. Record the following information in survey notebooks for each survey control point established and for all other survey, including designation of control point, datum used, elevation, date control point was established, description and sketch of control point location, and at least three reference features that can be seen from the control point.
b. Document survey work in field books using the following procedures: title and consecutively-numbered pages, table of contents, legend (including symbols used), notes on weather and equipment, personnel used for each task as applicable, date and time to record when work was performed, notes that can be interpreted by others with surveying knowledge, description of the survey control used.

C. Preliminary Surveys.
1. Earthwork staking: staking for cut-and-fills shall be used, with a maximum staking interval of 50 ft. Stakes shall be prominently noted with the description of the point, vertical distance to design elevation, and the offset distance where these descriptions apply.
2. Structures. Stake structure centerlines so the orientation, position, limits, and foundation elevation(s) are identified. Mark stakes to reflect design elevation and offset distance as applicable.
3. Ditches and Channels: Stake ditches and channels such that the layout remains undisturbed during construction.
4. Pipes and Culverts: Stake pipes and culverts on 50-ft maximum stationing. Place offset stakes beyond excavation limits and material stockpiles. Continuously check invert elevation during placement.

D. Final Surveys:

1. Final topography shall be staked at nominal 50-ft intervals. Additionally, the following points shall be staked and noted as applicable.

a. Grade breaks.

b. Mid-point of slopes less than 50 ft.

c. Points of horizontal curvature and tangency.

d. Points of stationing equation.

2. Pipes and culverts: Survey alignment and elevations at 50-ft maximum stations.

3.03 SURVEYS FOR MEASUREMENT AND PAYMENT

A. Perform surveys to determine quantities of work and percent of completed work.

B. Calculate and certify quantities and submit survey results, calculations, and certification to the Engineer for review and evaluation.

3.04 SURVEYS FOR CONFORMANCE CHECKS AND "AS-BULIT" DOCUMENTS

A. Survey the following surface to verify the lines and grades achieved during construction:

1. for berms, ditches, drainage swales, roads, top slopes, and other Earthwork:

a. original grade surface;

b. compacted surface of cut slopes; and

c. finished grade surface;

2. for the final cover system:

a. prepared waste surface;

b. finished intermediate cover and general fill layer;

c. top surface of cover protective layer; and

d. finished grade surface of vegetative layer;

4. for all leachate and/or gas piping:

a. top of pipe at 50-ft stations;

b. center of all wyes or other pipe branches; and

c. manhole connections.

B. Perform earthwork checks and "as-built" surveying immediately upon completion of a given installation to facilitate progress and avoid delaying commencement of the next installation. Provide the following minimum spacing and locations for survey points:

1. surfaces with gradients less than 10 percent, survey on a square grid spaced not wider than 50 ft.;

2. on slopes greater than 10 percent, a square grid spaced not wider than 50 ft. shall be used, but in any case, a line at the crest, midpoint, and toe of the slope shall be taken;

3. a line of survey points spaced not more than 50 ft, apart shall be taken along any slope break (this will include the inside edge and outside edge of any bench on a slope); and

4. a line of survey points spaced not more than 50 ft, apart shall be taken at the top of any pipes or other appurtenances.

[END OF SECTION]

SECTION 02110

CLEARING, GRUBBING, AND STRIPPING

SECTION 02110

CLEARING, GRUBBING, AND STRIPPING

PART 1 - GENERAL

1.01 SCOPE

A. This section describes the requirements for clearing, grubbing, and stripping activities.

1.02 RELATED SECTIONS AND PLANS

A. Section 02100 - Surveying

B. Section 02200 - Earthwork

C. Section 02290 - Erosion and Sediment Control

D. Section 02920 - Vegetative Layer

E. Section 02930 - Vegetation

F. Construction Quality Assurance (CQA) Plan

1.03 COMPLIANCE WITH REGULATIONS

A. It is the sole responsibility of the Contractor to be completely familiar with and to follow all local, state, and federal regulations pertaining to the work required in this section.

1.04 CONSTRUCTION QUALITY ASSURANCE

A. Clearing, grubbing, and stripping operations shall be monitored by the CQA Consultant as outlined in the CQA Plan.

B. The Contractor shall be aware of the activities set forth in the CQA Plan and shall account for these activities in the construction schedule.

C. The Contractor shall assist CQA personnel in every manner necessary for the proper performance of activities set forth in the CQA Plan.

D. CQA testing or inspection in no manner relieves the Contractor of the responsibility to perform all work in conformance with the Construction

Drawings and Technical Specifications.

E. If quality control or quality assurance tests indicate Work does not meet specified requirements, the Contractor shall remove Work, replace and retest at no additional cost to the Owner.

1.05 EXISTING CONDITIONS

A. The Contractor shall comply with applicable regulations in locating and providing clearance for all underground and above ground utilities prior to beginning construction activities. The Contractor shall immediately notify the Owner and the Engineer if utility lines or structures not shown on the Construction Drawings are encountered. Repair of damage and all restitution for liabilities resulting from damage to existing facilities due to activities by the Contractor shall be at the Contractor's expense.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Materials to be cleared include trees, shrubs, and any debris or other foreign matter, as needed to develop work areas and enable construction activities.

B. Stabilization and erosion control of stripped soil stockpiles shall be as specified in Section 02930.

PART 3 - EXECUTION

3.01 FAMILIARIZATION

A. Prior to implementing any of the work described in this Section, the Contractor shall become thoroughly familiar with the site, the site conditions, and all portions of the work falling within this Section.

B. Inspection:

1. Prior to implementing any of the work in this Section, the Contractor shall carefully inspect the installed work of all other Sections and verify that all work is complete to the point where the work of this Section may properly commence without adverse impact.

2. If the Contractor has any concerns regarding the installed work of other Sections, he shall notify the Engineer in writing prior to the commencement of operations. Failure to notify the Engineer will be

construed as Contractor acceptance of the related work of all other Sections.

3.02 EROSION AND SEDIMENT CONTROL

A. Prior to implementing any of the work described in this Section, the Contractor shall install all erosion and sediment controls in the relevant area(s) of construction. Erosion and sediment control shall be in accordance with Section 02290.

B. Contractor is solely responsible for selecting, implementing and maintaining proper and fully adequate erosion and sediment controls at all times during construction.

3.03 CLEARING AND GRUBBING

A. Clearing and grubbing shall be performed in areas identified on the Construction Drawings or as directed by the Engineer. All erosion and sediment controls shall be in place before the start of clearing, as indicated on the Construction Drawings.

B. If weather conditions are unsuitable for clearing and grubbing, as determined by the Engineer, the Contractor shall cease operations until permission to resume operations is obtained from the Engineer.

C. Clearing shall consist of removing trees, undergrowth, and deadwood. Trees shall be cut level with the adjacent ground surface.

D. Grubbing shall consist of the removal of stumps, roots, and surficial debris from the areas shown on the Construction Drawings or as directed by the Engineer.

E. Clearing and grubbing activities shall be performed in a manner so as to minimize disturbance to the surrounding areas.

F. All cleared and grubbed materials shall be reduced to mulch and stockpiled as directed by the Owner.

3.04 STRIPPING

A. Stripping shall consist of the removal of all vegetation, including roots and organic matter, grass, and other material unsuitable for use as subgrade or general fill.

B. Stripping shall be performed in areas shown on the Construction Drawings or as directed by the Engineer. All erosion and sediment controls shall be in place before the start of stripping.

C. If soil or weather conditions are unsuitable for soil and vegetation stripping, as determined by the Engineer, the Contractor shall cease stripping activities until permission to resume stripping activities is obtained from the Engineer.

D. Equipment and methods of operation shall be selected by the Contractor with the intent of minimizing disturbance to surrounding areas.

E. All stripped material shall be stockpiled in the areas indicated on the Construction Drawings or as directed by the Owner. Stockpiled material shall be sloped and stabilized as indicated on the Construction Drawings, specified in Section 02930, or as directed by the Engineer.

3.05 SURVEYING AND CONSTRUCITON TOLERANCES

A. The Contractor shall retain a Surveyor who shall be responsible for providing survey control of the Work. All surveying shall be performed in accordance with Section 02100.

3.06 PROTECTION OF WORK

A. The contractor shall use all means necessary to protect all prior work, including all materials and completed work of other Sections.

B. In the event of damage, the Contractor shall immediately make all repairs and replacements necessary, to the approval of the Engineer and at no additional cost to the Owner.

[END OF SECTION]

SECTION 02200

EARTHWORK

SECTION 02200

EARTHWORK

PART 1 - GENERAL

1.01 SCOPE

A. This Section includes site preparation, excavation, surface water control, excavation dewatering, stockpiling, general fill, final grade preparation, and other earthwork materials.

1.02 RELATED SECTIONS AND PLANS

A. Section 02100 - Surveying

B. Section 02110 - Clearing, Grubbing, and Stripping

C. Section 02215 - Trenching and Backfilling

D. Section 02240 - Protective Soil Layers

E. Section 02290 - Erosion and Sediment Control

F. Section 02920 - Vegetative Layer

G. Section 02930 - Vegetation

H. Construction Quality Assurance (CQA) Plan

1.03 REFERENCES

A. Latest version of American Society of Testing and Materials (ASTM) Standards.

1. ASTM D 698. Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3)).

2. ASTM D 2487. Standard Test Method for Classification of Soils for Engineering Purposes.

1.04 SUBMITTALS

A. Within 15 calendar days from Notice to Proceed, submit to the construction Manager for review an Earthwork Work Plan. The Earthwork Work Plan shall include, at a minimum:

1. list of equipment proposed for the construction activities including earthwork and for scope of work specified in Sections 02215, 02240, 02245, 02615, and 02920;

2. construction methods for each construction activity;

3. dewatering methods and techniques;

4. coordination of survey requirements for the earthwork;

5. proposed locations of temporary soil stockpile areas;

6. coordination of earthwork activities with surface water management and erosion and sediment control measures;

7. schedule for earthwork activities; and

8. dust control measures.

1.05 CONSTRUCTION QUALITY ASSURANCE

A. The earthwork will be monitored and tested by the CQA Consultant as required in the CQA Plan.

B. The CQA Consultant will perform soil conformance testing on general fill to establish compliance with this Section. Provide equipment and labor to assist the CQA Consultant in obtaining conformance samples from excavations and stockpiles.

C. The CQA Consultant will perform soil performance testing on the subgrade surface and general fill lifts to evaluate compliance with this Section. The CQA Consultant will indicate any portion of the earthwork that does not meet the requirements of the Section and will delineate the extent of the nonconforming area.

D. The Contractor shall correct all deficiencies and nonconformances identified by the CQA Consultant at no additional cost to the Owner.

E. The Contractor shall be aware of the activities required of the CQA Consultant by the CQA Plan and shall account for these activities in the construction schedule.

1.05 EXISTING CONDITIONS

A. Existing site surface and subsurface conditions, based on available site data, are indicated on the Construction Drawings.

B. Contractor shall verify existing conditions as indicated in Section 02100.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Obtain material for general fill from the on-site borrow sources approved by the Engineer.

B. General fill material shall be free of debris, foreign objects, large rock fragments, organics, and other deleterious materials. General fill material shall classify as SW, SP or SM according to the Unified Soil Classification System (per ASTM D 2487). General fill material having the indicated classification is expected to be available from approved on-site and off-site borrow sources. Soils having other classifications are acceptable as general fill, if approved by the Engineer.

C. General fill material used as prepared subgrade under the liner system of the landfill vertical expansion, and as intermediate soil cover under the final cover system of the landfill shall be free of sharp materials or any materials larger than 0.5 in. in particle size.

2.02 EQUIPMENT

A. Furnish compaction equipment to achieve the required minimum soil dry density within the range of acceptable moisture contents.

B. Furnish hand compaction equipment, such as a work-behind compactor, hand tampers, or vibratory plate compactor, for compaction in areas inaccessible to large compaction equipment.

C. Furnish water trucks, pressure distributors, or other equipment designed to apply water uniformly and in controlled quantities to variable surface widths for required in-place moisture adjustment, to prevent drying of soil surfaces,

and for dust control.

D. Furnish equipment such as excavators, scrapers, compactors, loaders, dozers, earth hauling equipment and all other equipment, as required for earthwork construction.

PART 3 - EXECUTION

3.01 GENERAL

A. All general fill material to be compacted shall be at a moisture content that will readily facilitate effective compaction.

3.02 SITE PREPARATION

A. Install construction fence and barricades around open trenches and excavated areas.

B. Install erosion and sediment controls in relevant areas of construction as indicated on the Construction Drawings and as required by Section 02290. Maintain the erosion and sediment controls for the duration of the Contract and until the contained areas are vegetated in accordance with Section 02930. Accumulated sediment behind silt fences and from drainage swales and structures shall be removed as required or as directed by the Engineer.

C. Prior to any earthwork activity, perform clearing, grubbing and stripping as indicated on the Construction Drawings and in accordance with Section 02110.

3.03 SURFACE WATER CONTROL

A. Installation of surface water and erosion controls shall be in accordance with Section 02290.

B. Install surface water and erosion controls in and around work areas to control runoff and erosion and to prevent surface water runon into excavations. Perimeter controls may include hallow ditches, berms, or localized regarding.

3.04 EXCAVATION

A. Excavate designated areas to the subgrade elevations or excavation limits indicated on the Construction Drawings. Stockpile excavated material in areas designated by the Construction Manager for use in subsequent construction.

3.05 EXCAVATION DEWATERING

A. Anticipate accumulation of surface water runoff in excavations. Surface water in excavation shall be managed by re-infiltration into site soils at a location outside the immediate work area. No water pumped from excavations shall be discharged from the site.

B. Prevent surface water runon from adjacent areas from entering the excavation.

C. All fill operations shall be performed in the dry. Contractor shall expect that groundwater is near the existing ground surface and shall be prepared to lower the groundwater in local areas as required to construct sumps and drainage structures. Groundwater pumped to facilitate construction activities shall be managed by re-infiltration into site soils at a location outside the immediate work area. No groundwater pumped from excavations shall be discharged from the site.

3.06 STOCKPILING

A. Separate stockpiles by material type.

B. Stockpile excavated soils at the areas indicated on the Construction Drawings or as designated by the construction Manager.

C. Construct stockpiles no steeper than 3H:1V (horizontal:vertical), grade to drain, seal by tracking perpendicular to the slope contours with a dozer, and dress daily during periods when fill is taken from the stockpile.

D. Silt fence or berms shall be constructed at the base of stockpiles that will not be immediately used.

E.Restore all areas used fro stockpiling when stockpiles are removed.

3.07 SUBGRADE PREPARATION

A. Subgrade material shall consist of soil free of debris, foreign objects, organics, and other deleterious materials.

B. Compact all subgrade within the limits of landfill cells to a minimum 95 percent of the standard Proctor (ASTM D 698) maximum dry density at a moisture content approved by the Engineer.

C. Perform subgrade proof rolling by driving a loaded dump truck (minimum weight of 10 tons per axle and minimum loaded weight of 20 tons) or other

pneumatic-tired vehicle, back and forth across the area to confirm the firmness of subgrade surface. Overlap the passes such that one set of tires on each pass runs between the two sets of tire tracts from the previous pass. Soils shall not exhibit pumping or develop ruts more than 2 inches in depth. Minor rutting, defined as less than 2 inches in depth, shall be regraded or covered with general fill to match finish grade.

D. Subgrade for general fill shall be scarified to a depth of 2 in using equipment specified in the Section.

E. Unsuitable soils shall be removed and replaced with general fill to a minimum depth of 2 ft below the proposed subgrade elevation. Suitable soil exhibiting pumping or developing ruts more than 2 inches in depth shall be removed to a minimum depth of 1 ft or dried in place, if feasible. Compact the general fill material to a minimum 95 percent of standard Proctor (ASTM D 698) maximum dry density at a moisture content approved by the Engineer.

F. In excavations or other areas where water accumulates, implement measures to remove the water in accordance with this Section. Maintain the subgrade surface free of standing water and in firm condition to meet proof rolling requirements of this Section. Maintain dewatered areas until overlying construction is complete.

G. Manage surface water as specified in Section 02290.

3.08 GENERAL FILL

A. Use fill that meets the requirements of this Section. Place fill to the limits and grades shown on the Construction Drawings.

B. Place general fill material on surfaces that are free of debris vegetation, and other deleterious material.

C. Place general fill material in loose lifts with a thickness of 8 in ± 1 inch. In areas where compaction is to be performed using hand operated equipment, place the fill material in loose lifts with a loose thickness of 4 in ± 1 inch.

D. Prior to placing a succeeding lift or material over a previously compacted lift, thoroughly scarify the previous lift to depth of 2 in by discing, raking, or tracking with a dozer. Moisture condition the preceding lift if not within the acceptable moisture range.

E. The trafficking of scarified surface by trucks or other equipment, except compaction equipment, is not permitted.

F. Except as specified in this Section, compact general fill in each lift to at least 95 percent of its standard Proctor maximum dry density (ASTM D 698). Compact general fill at moisture content as required to attain the specified density or as approved by the Engineer.

G. Do not place fill during periods of precipitation. Placement may occur during periods of misting or drizzle, but only as authorized by the Construction Manager.

H. Dust shall be controlled by the application of water to the general fill surfaces.

3.09 SURVEY CONTROL

A. Survey limits and elevations of excavations, top of general fill in accordance with Section 02100.

3.10 TOLERANCES

A. Perform the earthwork construction related to the final cover system to within ±0.3 ft of the elevations and within 10 percent of the slopes indicated or shown on the Construction Drawings.

B. Positively draining slopes shall be maintained in all cases.

[END OF SECTION]

SECTION 02215

TRENCHING AND BACKFILLING

SECTION 02215

TRENCHING AND BACKFILLING

PART 1 - GENERAL

1.01 SCOPE

A. This Section includes trenching, bedding and backfilling materials, and placement.

1.02 RELATED SECTIONS AND PLANS

A. Section 02100 - Surveying

B. Section 02200 - Earthwork

C. Section 02615 - Drainage Swales, Structures, and Downchutes

D. Section 02715 - HDPE Pipes and Fittings

E. Construction Quality Assurance (CQA) Plan

1.03 REFERENCES

A. Latest version of American Society of Testing and Materials (ASTM) Standards:

1. ASTM C 136. Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

2. ASTM D 698. Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3)).

3. ASTM D 2487. Standard Test Method for Classification of Soils for Engineering Purposes.

4. Latest version of engineering standards from the Departmento de Transportación y Obras Publicas, Manual de Diseño (DTOP Specifications)

5. Latest version of Occupational Safety and Health Administration (OSHA) Construction Standards.

1.04 SUBMITTALS

A. Submit the following to the Engineer with the Earthwork Work Plan specified in Section 02200 for review no less than 15 calendar days prior to use:

1. a list of equipment for trenching and backfilling;

2. for each source of embedment fill material, submit:

   a. the source of the embedment fill;

   b. the results of tests conducted on embedment fill samples in accordance with ASTM C 136 and ASTM D 2487; and

   c. a 50-pound representative sample of the embedment fill.

1.05 CONSTRUCTION QUALITY ASSURANCE

A. Trenching and backfilling will be monitored and tested by the CQA Consultant as required in the CQA Plan.

B. The Contractor shall be aware of the activities required of the CQA Consultant by the CQA Plan and shall account for these activities in the construction schedule.

C. The Contractor shall correct all deficiencies and nonconformances identified by the CQA Consultant at no additional cost to the Owner.

1.05 EXISTING CONDITIONS

A. In advance of trenching in an area, verify the accuracy of existing conditions shown on the Construction Drawings. Immediately notify the Engineer in writing of deviations from the existing conditions indicated on the construction Drawings.

B. The approximate locations of all known underground and above ground utilities and structures are indicated on the Construction Drawings.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Furnish embedment fill material for pipes, culverts and drainage structures meeting the requirements of the DTOP Specifications unless otherwise

indicated on the Construction Drawings.

B. Furnish trench backfill material for pipes, culverts and drainage structures meeting the material requirements for general fill as specified in Section 02200 unless otherwise indicated on the Construction Drawings.

C. Furnish trench backfill material for anchor trenches meeting the requirements for general fill as specified in Section 02200.

2.02 EQUIPMENT

A. Furnish, operate, and maintain all equipment necessary to perform the work of this Section.

PART 3 - EXECUTION

3.01 GENERAL

A. In areas of trenching and backfilling, maintain the protect existing above and below ground systems.

B. Do not damage or disturb above and below grade systems that are to remain.

3.02 TRENCHING

A. Trench soils for placement of pipes, culverts, drainage structures, and anchor trenches to the depths and minimum dimensions indicated on the construction Drawings. Where required fill material shall be placed and compacted to an elevation a minimum of 2 ft above pipes and culverts prior to trenching.

B. Use sheeting and bracing where and whenever necessary to maintain the safety and stability of all slopes and trenches and to protect adjacent structures. Satisfy all applicable local, state, and federal requirements for slope and trench sheeting and bracing, including requirements of the Occupational Safety and Health Administration (OSHA) Construction Standards. Provide required sheeting and bracing materials on site prior to the start of trenching. Adjust spacing and arrangement of sheeting and bracing as required by conditions encountered. Remove sheeting and bracing as backfill progresses. Fill any voids left from sheeting or bracing withdrawal with general fill or other approved material.

C. Protect and maintain the trench bottom. Remove rock fragments or raveled materials that collect on the trench bottom. Backfill excess excavation with general fill or other approved materials. Excavate any soft subgrade

encountered at the trench bottom and backfill and compact to subgrade elevation with embedment fill or general fill.

D. Dewater trenches and excavations as needed. Perform dewatering in accordance with Section 02200.

E. Stockpile excess material from trenching in accordance with Section 02200.

3.03 BACKFILLING

A. General:

1. do not backfill with saturated material;

2. do not backfill over wet or soft subgrade;

3. do not disturb or damage pipes, culverts, geosynthetics, or drainage structures in trenches and excavations during backfilling; and

4. do not used heavy compaction equipment which exerts greater than 5 pounds per square inch ground pressure over piping or geosynthetics that is covered by less than 12 inches of backfill material.

B. Placement of embedment fill for pipes, culverts, and drainage structures:

1. Place embedment fill in 7-inch ±1-inch thick loose lifts to the elevation of the bottom of the pipe, culvert, or drainage structure.

2. Compact embedment fill with a minimum of 4 passes of a vibratory place compactor prior to placing pipe or culvert.

3. Place pipe, culvert, or drainage structure on top of the compacted embedment fill.

4. For pipes or culverts 12 inches in diameter or less, place additional pipe embedment fill on the sides and hand tamp the fill around the sides as needed to ensure that intimate contact between the pipe or culvert and the embedment fill is maintained below the spring line. Continue placing embedment fill until it is even with the top of the pipe or culvert. Compact the embedment fill with a minimum of 4 passes of a vibratory plate compactor. Do not compact on top of the pipe or covert unless a minimum of 12 inches of trench backfill separates the compactor from the top of the pipe or culvert.

5. For pipes or culverts greater than 12 inches in diameter, place embedment fill in 7-inch ±1-inch thick loose lifts to the limits shown on the Construction Drawings. Compact each lift with a minimum of 4 passes of a vibratory place compactor.

C. Placement of backfill material for pipes, culverts, and drainage structures:

1. After placement and compaction of embedment fill, place the first lift of backfill material in a 12-inch loose lift. Place subsequent lifts of trench backfill material in 8-inch ±1-inch loose lifts.

2. Compact each lift to 95 percent of the maximum standard Proctor dry unit weight and at a moisture content generally within ±3 percent of the optimum moisture content as determined by ASTM D 698.

D. Trench backfill material for anchor trenches:

1. Place the anchor trench backfill material in 8-inch thick (±1 inch) loose lifts if mechanized compaction equipment will be used, and in 4-inch thick (±1 inch) loose lifts if hand compaction equipment will be used.

2. Compact the anchor trench backfill material to the minimum dry unit weight and within a range of acceptable moisture contents required for general fill in Section 02200.

3.04 SURVEY CONTROL

A. Survey limits and invert elevation of all pipes, culverts, and drainage structures in accordance with Section 02100.

B. Survey the limit and elevations of the top of all pipes, culverts, and drainage structures at each change in grade and every 50 feet between changes in grades in accordance with Section 02100.

C. Survey the limits and elevations of the bottom of the liner system and the final cover system anchor trench in accordance with Section 02100.

3.05 TOLERANCES

A. Install pipes, culverts, and drainage structures to within ±1 ft of the elevations and within 10 percent of the slopes indicated on the Construction Drawings.

B. Excavate anchor trenches within +0.2 ft of the depth indicated on the Construction Drawings.

[END OF SECTION]

SECTION 02225

LOW-PERMEABILITY SOIL LAYER

SECTION 02225

LOW-PERMEABILITY SOIL LAYER

PART 1 - GENERAL

1.01 SCOPE

A. This Section includes low-permeability soil and placement for construction of the soil component of the final cover system. The low-permeability soil specified in this section may be either a natural clayey soil or a betonies-soil mixture that meets the minimum material properties specified in the design drawings. Unless specific to one or the other soil option, the requirements of this section are applicable to both soil options.

1.02 RELATED SECTIONS AND PLANS

A. Section 02200 - Earthwork

B. Construction Quality Assurance (CQA) Plan

1.03 REFERENCES

A. Latest version of American Society for Testing and Materials (ASTM) Standards:

1. ASTM D 422. Standard Method for Particle-Size Analysis of Soils.
2. ASTM D 698. Standard Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using a 5.5 pound Rammer and 12-inch Drop.
3. ASTM D 2487. Standard Test Method for Classification of Soils for Engineering Purposes.
4. ASTM D 4318. Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
5. ASTM D 5084. Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials using a Flexible Wall Permeameter.
6. ASTM D 2922. Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
7. ASTM D 3017. Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
8. ASTM D 946. Standard Test Method for Water Adsorption of Bentonite by the Porous Plate Method.

1.04 SUBMITTALS AND NOTIFICATIONS

A. Submit a list of the equipment and plan of procedures to be used for placement and compaction of low-permeability soil within the final cover system to the Engineer for review with the Earthwork Work Plan as specified in Section 02200. For the betonite-soil option, include a list of equipment and procedures for batching, mixing, and placement.

B. For each source and/or variation of low-permeability soil material proposed, the Contractor shall submit the following information and samples to the Engineer a minimum of 28 days prior to the start of construction of the composite liner system:

1. the proposed material source or sources;

2. the results of grain-size analyses, to include hydrometer analysis, conducted on the proposed material in accordance with ASTM D 422;

3. the results of Atterberg limits analyses conducted on the proposed material in accordance with ASTM D 4318;

4. the results of moisture-density relation test conducted on the proposed material in accordance with ASTM D 698;

5. the results of hydraulic conductivity testing performed in accordance with ASTM D 5048 for a minimum of 8 data points at a water content and dry density varying between 90 and 110 percent and ± 4 percent of the standard Proctor maximum dry density and optimum water content, respectively; and

6. a 50-pound sample of each proposed soil.

C. The Contractor shall test the low-permeability soil at the source at a frequency of one test per 5,000 cubic yards. Testing shall include grain-size analyses conducted in accordance with ASTM D 422 and Atterberg limits conducted in accordance with ASTM D 4318. The Contractor shall submit the results of these tests to the CQA Consultant.

D. Submit to the Engineer for review not less than 30 days prior to use a specification sheet for the proposed betonies powder or granules and a 5-pound representative sample of the material.

E. The Contractor shall notify the Engineer in writing a minimum of 7 days in advance of intention to perform the work of this section.

F. If the work is interrupted for reasons other than inclement weather, the contractor shall notify the Engineer a minimum of 24 hours prior to the resumption of work.

1.05 CONSTRUCTION QUALITY ASSURANCE

A. The low-permeability soil work will be monitored and tested by the CQA Consultant as required in the CQA Plan.

B. The CQA Consultant will perform soil conformance testing on low-permeability soil to establish compliance with this Section. Conformance testing on low-permeability soil will be performed on materials obtained both from the source and after placement in the cover system. Provide equipment and labor to assist the CQA Consultant in obtaining conformance samples from excavations, stockpiles, and borrow areas. Identify sources(s) of low-permeability soil material at least 21 calendar days prior to use.

C. The CQA Consultant will perform soil performance testing on low-permeability soil lifts to evaluate compliance with this section. The CQA Consultant will indicate any portion of the low-permeability soil that does not meet the requirements of this section and will delineate the extent of the nonconforming area.

D. The Contractor shall correct all deficiencies and nonconformances identified by the CQA Consultant at no additional cost to the Owner.

E. The Contractor shall be aware of the activities required of the CQA Consultant by the CQA Plan and shall account for these activities in the construction schedule.

PART 2 - PRODUCTS

2.01 LOW-PERMEABILITY SOILS

A. The materials comprising the natural low-permeability soil component of the composite liner system shall consist of relatively homogeneous, fine grained, natural soils, which are free of materials, which, due to its nature or size, are deleterious to the intended use as determined by the Engineer. At least 50 percent by weight shall pass the Number 200 sieve and no particles larger than 0.75 in. shall be allowed. The soils shall be classified according to the Unified

soil Classification System (USCS) as a CL or CH material.

B. Regardless of classification of the soil material comprising the low-permeability soil components of the liner system the compacted soil shall be capable of achieving an in-situ hydraulic conductivity less than or equal to 1.0×10^{-5} cm/sec at a confining stress of 20 psi when tested in accordance with ASTM D 5084.

C. The soil materials for the low-permeability soil components shall be supplied from off-site sources approved by the Engineer. All low-permeability soil material taken from these sites shall be uniform and shall not contain any substandard materials. Substandard materials shall be segregated at the source and will not be permitted on the job site. Any material that is found by the Engineer to be substandard will be removed from the site. Notwithstanding the Engineer's approval of these sites, the Contractor shall be entirely responsible for meeting the requirements of this section. The laboratory test results on which approval of a site is based shall be provided by the Contractor and the CQA Consultant.

2.02 LOW-PERMEABILITY SOIL OPTION

A. In the event that the specified hydraulic conductivity cannot be achieved with off-site soils alone, the Contractor shall use a betonies-soil mixture as an alternate material for the low-permeability soil.

B. Furnish betonite powder or granules consisting of Wyoming-grade betonite containing at least 85 percent sodium montmorillonite, and a water adsorption of at least 500 percent when tested in accordance with ASTM E 946.

C. Bentonite-Soil Mixture

1. The soil component of the betonies-soil mixture shall consist of relatively homogeneous natural soils, which are free of materials, which due to its nature or size, are deleterious to the intended use as determined by the Engineer. No materials larger than 0.75 in. shall be allowed. The soil shall classify as an SP, SM, SC, or ML, according to the USCS.

2. The contractor shall employ an approved independent testing laboratory to design the betonies-soil mixture to meet the requirement of an in-situ hydraulic conductivity of less than 1×10^{-5} cm/s at a confining stress of 20 psi when tested in accordance with ASTM 5084.

3. The contractor shall present in writing the proposed procedure to mix the soil and betonies in the field, the equipment that will be used, and the

quality control procedures that will be implemented.

4. The final approval of the proposed betonies-soil mixture will be at the sole discretion of the Engineer.

2.03 ESTABLISHMENT OF THE COMPACTION CRITERIA

A. The data from Contractor testing required by this section and conformance testing by the CQA Consultant will be used by the Engineer to establish the acceptable range of soil water contents and dry densities for field compaction, referred to herein as the acceptable permeability zone (APZ).

B. Using the actual low-permeability soil and actual compaction equipment proposed by the Contractor a test pad will be constructed on the base of cell to be constructed.

C. Based on the laboratory testing and test pad construction, the Engineer will establish, at his sole discretion, the criteria to achieve the required hydraulic conductivity in the field.

2.04 EQUIPMENT

A. For the low-permeability soil option, use batching, mixing, and conveying equipment as approved by the Engineer.

B. Use suitable hauling and placing equipment to spread low-permeability soil material in uniform loose lift thicknesses.

C. Use tank trucks, pressure distributors, and other equipment designed to apply water uniformly and in controlled quantities to moisture condition the low-permeability soil material. After adding water, the low-permeability soil must be processed to uniformly distribute the moisture with a soil scarifier or other equipment as approved by the Engineer.

D. Use the following equipment for compacting the low-permeability soil lifts in the composite liner system:

1. Caterpillar 815-F; or

2. An equivalent self-propelled equipment approved by the Engineer.

PART 3 - EXECUTION

3.01 FAMILIARIZATION

A. Prior to implementing any work of this section, the Contractor shall become thoroughly familiar with the site, the site conditions, and all portions of the work falling within this Section.

B. Prior to implementing any work of this section, the Contractor shall carefully inspect the installed work of all other Sections and verify that all such work is complete to the point where the installation of this Section may properly commence without adverse impact.

3.02 LOW-PERMEABILITY SOIL PERFORMANCE CRITERIA

A. The moisture content and dry density of low-permeability soil material shall be within the APZ defined as those combinations of moisture content and dry density that, through preconstruction laboratory testing by the Contractor and the CQA Consultant, result in a low-permeability soil hydraulic conductivity (measured in laboratory using ASTM D 5084) of not more than 1×10^{-5} cm/s. The APZ will also meet the following three criteria: (i) moisture content that results in a degree of soil saturation of at least 90 percent; (ii) moisture content not greater than 4 percentage points wet of the standard Proctor optimum moisture content (ASTM D 698); and (iii) dry unit weight of at least 95 percent of the standard Proctor maximum dry unit weight (ASTM D 698). The CQA Consultant will provide the Contractor with specific moisture contents and dry weights that satisfy these criteria for each material used in compacted soil liner construction.

3.03 TEST PAD CONSTRUCTION

A. The purpose of the test pad is to establish the placement and compaction methods and procedures to be used to construct the low-permeability soil component of the liner system, and to verify that compaction in the APZ produces a layer having a hydraulic conductivity of less than or equal to 1×10^{-5} cm/s. The test pad program shall allow all parties (including the Engineer, Contractor, and CQA Consultant) to:

1. familiarize themselves with the handling and compaction characteristics of the proposed low-permeability soil materials;

2. develop correlations between numbers of passes, soil water content and soil dry density; and

3. develop correlations between moisture content and moisture conditioning requirements.

B. The test pad shall be in an area of the project site designated by the Engineer and shall be constructed and tested as specified in this Section or by an alternate procedure as approved by the engineer.

C. The surface of the subgrade shall be proof-rolled to identify soft zones, irregularities, and abrupt changes in grade. The finished subgrade shall be graded to final slopes as indicated in the Construction Drawings. No standing water or excessive moisture shall be allowed to accumulate on the surface of the subgrade. The surface of the subgrade shall be examined by the CQA Consultant prior to commencement of construction of the test pad.

D. The test pad shall be constructed in a rectangular shape to a minimum plan area of 30 ft wide by 80 ft long. The test pad should consist of at least four lifts of low-permeability soil or as determined by the Engineer. Each lift shall be of uniform thickness with a maximum compacted thickness of 6 in.

E. Soil Placement

1. The test pad shall be constructed in horizontal lifts in accordance with methods and procedures outlined below. The compaction parameters that will be evaluated in the test pad include:

   a. compaction equipment;

   b. number of passes and speed of the compaction equipment;

   c. soil moisture content;

   d. bonding between lifts; and

   e. quality control procedures.

2. First Lift:

   a. The placement, compaction, and testing of the soils in the first lift of the test pad shall be in accordance with the following requirements:

      i. the Contractor will, by trial and error, determine the method to break down soil clods to the maximum diameter of 3 in.

ii. the Contractor shall, by trial and error, determine the loosely-placed soil thickness, which will result in a compacted lift thickness of 6 in. and upon determining this, place the first lift of soil;

iii. the soil moisture content shall be adjusted by the Contractor, as required, to meet the required moisture content established during the laboratory testing;

iv. the soil shall be compacted with two one-way passes, using the same compaction equipment intended for the actual construction;

v. the soils CQA Consultant will perform in-situ water content and dry density tests using the ASTM D 2922 and D 3017;

vi. all perforations made as a result of sampling or testing shall be filled;

vii. the lift shall be further compacted (second sequence) by applying two additional one-way passes with the same construction equipment as for the first two passes;

viii. the testing, sampling and repair outlined in (v) and (vi) above shall be repeated at locations adjacent to the first set of tests;

ix. the lift shall be further compacted (third sequence) by applying two additional one-way passes with the same construction equipment as for the previous passes;

x. the testing, sampling, and repair outlined in (v) and (vi) above shall be repeated at locations adjacent to the first two sets of tests; and

xi. additional sequences of compaction, testing, sampling, and repair shall be carried out until the specified criteria for compaction are attained; at that point, a final set of two passes shall be carried out, followed by a final sampling and patching.

3. Subsequent Lifts:

   a. The placement, compaction, and testing of the soils in the second lift of the test pad and subsequent lifts, if required shall be in accordance

with the following requirements:

i. the Contractor shall place a second loose soil lift which will result in a compacted lift thickness of 6 in. (150mm);

ii. the Contractor shall ensure that a good bond exists between the two lifts, and the CQA Consultant shall verify that the two lifts are intermixed; and

iii. sequences of compaction, testing, sampling, and repair shall be carried out in a manner identical to the first lift until the specified criteria for compaction are attained.

3.04 MATERIAL PLACEMENT

A. The Contractor shall construct the low-permeability soil component of the cover system by over-building to compactable lines and grades and then by the controlled excavation to the grades, slopes and elevations indicated on the Construction Drawings.

B. The Contractor shall place the low-permeability soil on a surface meeting the compaction requirements of Section 02200.

C. The low-permeability soil shall be spread and compacted in lifts not to exceed 6 in. compacted thickness. The soil prior to compaction shall not have soil clods larger than 3 inches in maximum dimension.

D. The Contractor shall use, as a minimum, the compaction equipment used in the construction of the test pad and construction methods based on the results of the test pad to achieve the compaction criteria.

E. The moisture content of the low permeability soil material shall be within the range of the moisture content established by the CQA Consultant. If the soil is too dry for proper compaction, the Contractor shall spray the soil with a sufficient quantity of clean water and thoroughly mix with the soil to bring the soil to the proper moisture content.

F. Prior to compaction, the Contractor shall spread the low-permeability soil to a uniform thickness. Each lift shall be compacted to the required minimum dry density, within the acceptable range of water contents, as established by the CQA Consultant.

G. At the beginning of each day's work, the previously placed low-permeability soil shall be inspected by the CQA Consultant. The surface shall be scarified

before commencement of the day's work. The CQA Consultant may specify recompaction of the top surface of soil and recompaction, as necessary in the judgment of the CQA Consultant, to meet the specified criteria and provide a suitable surface for the next lift. This work will be performed at no additional cost to the Owner.

H. No low-permeability soil shall be placed over a lift that has not been tested and approved by the CQA Consultant. Should the field tests indicate that the density of any layer of low-permeability soil or portion thereof is below the required dry density, the particular layer or portion thereof shall be reworked at no additional cost to the Owner.

I. No frozen or thawing low-permeability soil shall be placed, spread, or compacted.

J. No low-permeability soil material shall be placed, spread, or compacted while the subgrade is frozen or thawing, during unfavorable weather conditions, or periods of precipitation.

K. Hand compaction at the proper moisture content shall be used in all places around penetrations, corners, appurtenances, etc., in order to achieve the specified criteria. Care shall be taken to protect piping, geomembranes, and other structures. Damage to any materials or work caused by hand compaction shall be replaced by the Contractor at no additional cost to the Owner.

L. The same material and compaction methods as outlined in these specifications shall be used to replace unacceptable zones detected as part of the Construction Quality Assurance Program.

M. The low-permeability soil surface must be made free from ruts or indentations at the end of every working day.

N. The Contractor shall finish each day's work with a smooth roller to create a smooth surface, which will minimize moisture penetration.

O. Each low-permeability soil lift will be covered with a temporary plastic cover as necessary to prevent drying or cracking immediately after the lift has passed the testing requirements and been approved by the Engineer, and at the end of each day.

3.05 MATERIAL COMPACTION

A. Compact loose lifts using a minimum of six passes of the compaction equipment. Provide as many additional passes as required to achieve the performance criteria specified in this Section.

B. For a dual-drum compactor with laterally-separated front and rear drum, a compaction pass is defined as one trip up and a staggered trip back to cover the uncompacted area between the drums (i.e., one full coverage).

C. Compact areas inaccessible to driven compaction equipment using hand operated equipment.

D. Avoid crusting and desiccation of the lift surface. In the event crusting or desiccation occurs, rework the soil in accordance with this Section.

E. Prepare the last lift of the compacted soil liner to meet the minimum thicknesses and grades indicated on the Construction Drawings. Meet the construction tolerance requirements given in this Section.

F. Any loose soil on the surface of the last lift shall have a maximum particle size of 0.25 inches.

3.06 PERFORATIONS

A. Backfill perforations in the low-permeability soil layer lifts resulting from sand-cone tests, drive cylinders, survey stakes, or other activities. The CQA Consultant will identify perforations requiring backfill. Perforations resulting from nuclear density tests will be filled by the CQA Consultant.

B. Prepare soil-bentonite mix for use in backfilling of perforations consisting of a minimum of 10 percent by weight bentonite powder or granules mixed with soil liner material by dry weight basis.

C. Backfill perforations with soil-bentonite mix. Place soil-bentonite mix in these perforations in approximately 3-inch thick loose lifts and thoroughly compact.

D. Perforations in the low-permeability soil layer lifts resulting from nuclear density testing will be backfilled with bentonite powder or granules or the soil-bentonite mix furnished by the Contractor and compacted by hand tamping by the CQA Consultant.

3.07 PROTECTION OF THE WORK

A. The Contractor shall use all means necessary to protect all prior work, including all materials and completed work of other Sections.

B. In the event of damage, the Contractor shall immediately make all repairs and replacements necessary to the approval of the Engineer at no additional cost to the Owner.

3.08 SURVEY CONTROL

A. Survey the limits and elevations of the low-permeability soil layer in accordance with Section 02100.

3.09 TOLERANCES

A. Construct the low-permeability soil layer to a thickness within ± 0.1 feet of the elevations indicated on the Construction Drawings.

B. Construct low-permeability soil layer to within 10 percent of the slopes indicated on the Construction Drawings unless otherwise indicated by the Engineer.

[END OF SECTION]

SECTION 02230

ROAD CONSTRUCTION

SECTION 02230

ROAD CONSTRUCTION

PART 1 - GENERAL

1.01 SCOPE

A. This Section describes the requirements for constructing the road on top of the perimeter berm and at other locations shown on the Construction Drawings or otherwise specified by the Owner. Work shall also include the construction of the interior perimeter berm swale as indicated on the Construction Drawings.

1.02 RELATED SECTIONS AND PLANS

A. Section 02100 - Surveying

B. Section 02200 - Earthwork

C. Section 02900 - Vegetation

D. Construction Quality Assurance (CQA) Plan

1.03 REFERENCES

A. Latest version of American Society of Testing and Materials (ASTM) Standards:

1. ASTM D 698. Standard Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using a 5.5-lb (2.49-kg) Rammer and 12-in. (305-mm.) Drop.

2. ASTM D 2487. Standard Test Method for Classification of Soils for Engineering Purposes (Unified Soil Classification).

B. Latest version of engineering standards from the Departmento de Transportación y Obras Publicas, Manual de Diseño (DTOP Specifications).

1.04 SUBMITTALS

A. At least 14 days prior to the start of road construction, the Contractor shall provide to the Engineer for review the equipment and construction method for placing and compacting the road materials.

B. For each source of the base material, submit the following to the Engineer for review at least 21 calendar days prior to road construction:

1. source of the material;

2. test results conducted on three samples of the material that demonstrates the material meets the requirements of the DTOP Specifications; and

3. a 50-pound representative sample of the proposed material.

1.05 CONSTRUCTION QUALITY ASSURANCE

A. The construction of the roads will be monitored by the Engineer as required by the CQA Plan.

B. The CQA Consultant will perform material conformance testing and installation quality control testing during road construction as required by the CQA Plan.

C. The Contractor shall be aware of the activities required by the CQA Consultant in the CQA Plan and account for these activities in the construction schedule.

D. The Contractor shall correct all deficiencies and nonconformances identified by the CQA Consultant at no additional cost to the Owner.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Furnish base material for the perimeter maintenance road meeting the requirements of Base Course in DTOP Specifications. Contractor shall submit reports of testing and supplier certifications showing that base material meets this section at least 21 days before material is delivered to the site.

B. Alternate base material may consist of a crushed concrete aggregate as approved by the Engineer. Contractor shall submit reports of testing and supplier certificates showing that alternate base material meets this section at least 21 days before material is delivered to the site.

C. Furnish embankment material and prepared subbase materials for the perimeter maintenance road meeting the requirements of general fill material in Section 02200 from the on-site borrow areas or other areas as designated by the Engineer.

2.02 EQUIPMENT

A. Furnish, operate, and maintain equipment necessary to construct roads in accordance with the requirements of this section.

B. Use Caterpillar CS 563 or equivalent self-propelled vibratory compactor, as approved by the Engineer, for compacting the subgrade, embankment, and base materials.

PART 3 - EXECUTION

3.01 PERIMETER ROAD

A. The perimeter road hall be constructed to the thickness, grades, lines, and limits indicated on the Construction Drawings.

B. The base materials shall be placed in two equal lifts and compacted to the grades, lines, and limits indicated on the Construction Drawings and compacted in accordance with this Section.

C. The interior perimeter berm swale shall be constructed, graded, and sodded in accordance with the Construction Drawings.

3.02 COMPACTION REQUIREMENTS AND TEST FREQUENCIES

A. Embankment materials for perimeter maintenance road shall be compacted to 95 percent of maximum dry density determined by ASTM D 698. Construction quality control test will be performed by the CQA Consultant at a minimum frequency of one test for every 200 linear feet per lift or as directed by the Engineer.

B. Prepared subbase for perimeter road shall be compacted to 100 percent of maximum dry density as determined by ASTM D 698. Construction quality control tests will be performed by the CQA Consultant at a minimum frequency of one test for every 200 linear feet per lift or as directed by the Engineer.

C. Base course materials for perimeter road shall be compacted to 95 percent of maximum dry density as determined by ASTM D 698 or as directed by the Engineer. Construction quality control tests will be performed by the CQA Consultant at a minimum frequency of one test for every 200 linear feet per lift or as directed by the Engineer.

3.03 SURVEY CONTROL

A. Survey the grades, lines, and limits of the perimeter maintenance road construction in accordance with Section 02100 to verify compliance with the Construction Drawings.

3.04 TOLERANCES

A. Place and compact embankment materials and base materials to ± 0.1 ft of the elevations indicated on the Construction Drawings.

B. Construct the perimeter maintenance road to within ±0.1 ft of the final grades and slopes indicated on the Construction Drawings.

[END OF SECTION]

SECTION 02245

RIPRAP

SECTION 02245

RIPRAP

PART 1 - GENERAL

1.01 SCOPE

A. This Section includes riprap products and placement.

1.02 RELATED SECTIONS AND PLANS

A. Section 02615 - Drainage Swales, Structures and Downchutes

B. Section 02720 - Geotextiles

C. Construction Quality Assurance (CQA) Plan

1.03 REFERENCES

A. Latest version of engineering standards from the Departmento de Transportación y Obras Publicas, Manual de Diseño (DTOP Specifications).

1.04 SUBMITTALS

A. Submit the following to the Engineer for review at least 30 calendar days prior to riprap use:
   1. the source of the riprap; and
   2. certification from the supplier that the riprap meets the material requirements of this Section.

1.05 CONSTRUCTION QUALITY ASSURANCE

A. The placement of riprap will be monitored by the CQA Consultant as required by the CQA Plan.

B. The CQA Consultant will perform material conformance testing as required by the CQA Plan.

C. The Contractor shall be aware of the activities required of the CQA Consultant by the CQA Plan and account for these activities in the construction schedule.

D. The Contractor shall correct all deficiencies and nonconformances identified by the CQA at no additional cost to the Owner.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Riprap shall consist of hard, durable, angular field or quarry stone.

B. Riprap for drainage swales shall conform to applicable sections of the DTOP Specifications.

PART 3 - EXECUTION

3.01 PLACEMENT

A. Place riprap to the thickness, elevations, and locations indicated on the Construction Drawings.

B. Place riprap over geotextile separator meeting requirements of Section 02720 and over prepared layers as indicated on the Construction Drawings.

C. Carefully place riprap to avoid segregation or disturbance or damage of the underlying material. Place the material in such a manner as to produce a well graded mass of riprap with the minimum practicable percentage of voids. Distribute the larger pieces throughout the entire mass such that the finished riprap is free from objectionable pockets of small or large pieces.

D. Do not place riprap by dumping into chutes or by similar methods likely to cause segregation of various sizes.

E. Do not place riprap in a manner that causes damage to an underlying geotextile separator or geocomposite. Repair damaged geotextile as directed by the Engineer and in accordance with Section 02720.

3.02 SURVEY CONTROL

A. Survey the limits of riprap placement in accordance with Section 02100.

3.03 TOLERANCES

A. Place the riprap to the minimum thickness as indicated on the Construction Drawings.

[END OF SECTION]

SECTION 02290

EROSION AND SEDIMENT CONTROL

SECTION 02290

EROSION AND SEDIMENT CONTROL

PART 1 - GENERAL

1.01 SCOPE

A. The contractor shall furnish all labor, materials, tools, and incidentals required to install permanent erosion and sediment controls.

B. The Contractor shall furnish all labor, materials, tools, and incidentals required to install and maintain all temporary erosion and sediment control measures and structures including, but not limited to silt fence, straw bales, check dams, and sediment traps, throughout the duration of the project and remove temporary measures and structures, where necessary.

1.02 RELATED SECTIONS AND PLANS

A. Section 02100 - Surveying

B. Section 02110 - Clearing, Grubbing, and Stripping

C. Section 02200 - Earthwork

D. Section 02245 - Riprap

E. Section 02615 - Drainage Swales, Structures and Downchutes

F. Section 02720 - Geotextiles

G. Section 02920 - Vegetative Layer

F. Construction Quality Assurance (CQA) Plan

1.03 REFERENCES

A. The Florida Stormwater, Erosion, and Sedimentation Control Inspector's Manual, First Edition, January 1999.

1.04 COMPILANCE WITH REGULATIONS

A. It is the sole responsibility of the Contractor to be completely familiar with and to follow all local, state, and federal regulations pertaining to the work required in this Section.

1.05 CONSTRUCTION QUALITY ASSURANCE

A. Erosion and sediment control activities shall be monitored as outlined in the CQA Plan.

B. The Contractor shall be aware of the activities required of the CQA Consultant by the CQA Plan and account for these activities in the construction schedule.

C. The Contractor shall assist CQA personnel in every manner necessary for the proper performance of activities set forth in the CQA Plan.

D. CQA testing or inspection does not relieve the Contractor of the responsibility to construct all work in conformance with the Construction Drawings and Technical Specifications.

E. If quality control or quality assurance tests indicate Work does not meet specified requirements, the Contractor shall remove Work, replace and retest at no additional cost to the Owner.

1.06 SUBMITTALS

A. The Contractor shall submit samples and manufacturer's product data and recommended methods of installation for the proposed silt fence to the Engineer at least 14 days prior to starting installation. The manufacturer's product data shall provide documentation and certification that the silt fence products meet or exceeds the requirements specified in this Section.

PART 2 - PRODUCTS

2.01 SILT FENCE

A. Furnish silt fence with either woven or nonwoven fabric. Silt fence shall:

1. be woven fabric consisting of slit films of polypropylene treated with ultraviolet light stabilizers;

2. be nonwoven fabric consisting of long chain polymeric filaments or polyester yarns;

3. be inert to chemicals commonly found in soils and to hydrocarbons;

4. be resistant to mildew, rot, insects, and rodent attack;

5. have fence posts of minimum 2" x 2" lumber and minimum length of 36 inches spaced a maximum of 6 ft along fabric; and

6. have a minimum fabric width of 36 inches.

2.02 RIPRAP

A. Riprap shall be specified in Section 02245.

2.03 GEOTEXTILE SEPARATOR

A. Geotextile separator shall be as specified in Section 02720.

2.04 VEGETATION

A. Vegetation shall be specified in Section 02930.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Silt fence shall be installed in accordance with the manufacturer's recommendations in all areas as indicated on the construction Drawings prior to any other construction activities. Minimum fabric burial depth shall be 6 inches or manufacturer's recommendation, whichever is greater.

B. The outside slope of all perimeter and roadway storm water management berms shall be sodded immediately after final grading and shaping.

C. The Contractor shall use straw bales to contain sediment and water from dewatering operations and promote infiltration. Accumulated sediment shall be removed and stockpiled for reuse.

3.02 PROTECTION OF WORK

A. The Contractor shall use all means necessary to protect all prior work, including materials and completed work of other sections.

B. In the event of damage, the Contractor shall immediately make all repairs and replacements necessary, to the approval of the Engineer at no additional cost

to the Owner.

[END OF SECTION]

SECTION 02615

DRAINAGE SWALES, STRUCTURES, AND DOWNCHUTES

SECTION 02615

DRAINAGE SWALES, STRUCTURES, AND DOWNCHUTES

PART 1 - GENERAL

1.01 SCOPE

A. This Section includes products and installation of drainage swales and precast concrete drainage structures.

1.02 RELATED SECTIONS AND PLANS

A. Section 02200 - Earthwork

B. Section 02215 - Trenching and Backfilling

C. Section 02245 - Riprap

D. Construction Quality Assurance (CQA) Plan

1.03 REFERENCES

A. Latest version of engineering standards from the Departmento de Transportación y Obras Publicas, Manual de Diseño (DTOP Specifications).

1.04 SUBMITTALS

A. Submit shop drawings of all precast concrete drainage structures to the Engineer for approval a minimum of 30 days prior to use on this project.

1.05 CONSTRUCTION QUALITY ASSURANCE

A. The drainage swale and structure construction will be monitored by the CQA Consultant as required by the CQA Plan.

B. The CQA Consultant will perform material conformance testing and installation quality control testing during drainage swale and structure construction as required by the CQA Plan.

C. The Contractor shall be aware of the activities required of the CQA Consultant by the CQA Plan and account for these activities in the construction schedule.

D. The Contractor shall correct all deficiencies and nonconformances identified by the CQA at no additional cost to the Owner.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Drainage structures shall conform to applicable sections of the DTOP Specifications.

B. Riprap shall be as specified in Section 02245.

C. Geotextile separator shall be as specified in Section 02720.

PART 3 - EXECUTION

3.01 PREPARATION

A. All excavation, shoring, and stormwater control required for the construction of drainage structures shall be performed in accordance with Section 02200.

B. Excavation shall be to the required depth. Over-excavated areas shall be backfilled with general fill material, properly compacted as specified in Section 02200 and Section 02215.

3.02 INSTALLATION

A. Drainage Structures

1. Set drainage structures at the proper elevation with proper bearing on a suitable foundation.

2. Pipe openings shall be neatly cut two inches larger than the outside diameter of the incoming pipe. Fill openings around pipe with non-shrink grout to provide a smooth watertight joint between structure and pipe.

3. Cut pipe entering the structure to the correct length prior to installation. Removal of excess pipe in structure after installation will not be acceptable.

3.03 SURVEY CONTROL

A. Survey the location and elevation of all drainage swales and structures and the lines, slopes, and grades in accordance with Section 02100.

3.04 TOLERANCES

A. Install drainage swales and structures to within ±0.1 ft of elevations indicated on the Construction Drawings or as directed by the Engineer.

[END OF SECTION]

SECTION 02620

CULVERTS

SECTION 02620

CULVERTS

PART 1 - GENERAL

1.01 SCOPE

A. This Section includes culverts and related appurtenances, products, and installation.

1.02 RELATED SECTIONS AND PLANS

A. Section 02100 - Surveying

B. Section 02200 - Earthwork

C. Section 02215 - Trenching and Backfilling

D. Construction Quality Assurance (CQA) Plan

1.03 REFERENCES

A. Latest version of American Association of State Highway Transportation Officials (AASHTO) Standards.

1. AASHTO M 36. Standard Specification for Corrugated Steel Pipe, Metallic-Coated, for Sewers and Drains

2. AASHTO M 170. Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.

3. AASHTO M 198. Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe Using Flexible Watertight Gaskets.

4. AASHTO M 273. Standard Specification for Precast Reinforced Concrete Box Sections for Culverts, Storm Drains, and Sewers with Less than 2 feet of Cover Subject to Highway Loadings.

5. AASHTO M 274. Standard Specification for Steel Sheet, Aluminum-Coated (Type 2) for Corrugated Steel Pipe.

B. Latest version of engineering standards from the Departmento de Transportación y Obras Publicas, Manual de Diseño (DTOP Specifications).

1.04 SUBMITTALS

A. Submit the following to the Engineer for review not less than 30 calendar days prior to use:

1. culvert manufacturer's product data and recommended methods of storage, handling, and proposed installation;

2. shop drawings showing the layout and details of joints, special connections, and fittings:

3. culvert manufacturer's written certification that culverts and joint material meet the material requirements of this section.

PART 2 - PRODUCTS

2.01 GENERAL

A. Furnish corrugated metal pipe (CMP), reinforced concrete pipe (RCP) circular, or box culverts at the locations and with the dimensions indicated on the Construction Drawings and in accordance with DTOP Specifications.

2.02 CMP CULVERS

A. Furnish CMP culverts meeting the requirements of AASHTO M 36.

2.03 RCP CIRCULAR AND BOX CULVERTS

A. Furnish RCP circular culverts meeting the requirements of AASHTO M 170 for Class IV and V Reinforced Concrete Pipe with Wall B.

B. Furnish RCP box culverts meeting the requirements of AASHTO M 273 for Precast Reinforced Concrete Box sections with Less Than 2 Feet of Cover Subjected to HS20 Loading.

2.04 JOINTS

A. Seal RCP circular joints with Type A culvert gaskets meeting the requirements of AASHTO M 198.

B. Seal RCP box culvert joints with bituminous pipe joint filler meeting the requirements of the FDOT Specifications.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Examine culverts and joint materials before installation for workmanship. Do not install any culvert or joint material that shows poor workmanship.

B. Prior to culvert installation, complete trench excavation and install embedment fill in accordance with the requirements of Section 02215 unless otherwise indicated on the Construction Drawings.

C. Install CMP, RCP circular, and box culverts to the lines and grades indicated on the Construction Drawings, to the survey tolerances specified in this section.

D. Install joints for RCP circular and box culverts in accordance with manufacturer's recommendations and at the locations indicated on the Construction Drawings.

E. After placement of the culverts, perform backfilling as specified in Section 02215 unless otherwise indicated on the Construction Drawings.

3.02 SURVEY CONTROL

A. Survey the final locations and invert elevations of the culverts in accordance with Section 02100.

3.03 TOLERANCES

A. Construct culverts to within ±0.1 ft of the invert elevations shown on the Construction Drawings, and to provide positive drainage at all times.

B. Construct culverts to within ±0.1 ft of the lines and grades as indicated on the Construction Drawings.

[END OF SECTION]

SECTION 02715

HIGH-DENSITY POLYETHYLENE (HDPE) PIPES AND FITTINGS

SECTION 02715

HIGH-DENSITY POLYETHYLENE (HDPE) PIPE AND FITTINGS

PART 1 - GENERAL

1.01 SCOPE

A. This Section includes high-density polyethylene (HDPE) pipe and fittings installation and products.

1.02 RELATED SECTIONS AND PLANS

A. Section 02100 - Surveying

B. Section 02215 - Trenching and Backfilling

C. Construction Quality Assurance (CQA) Plan

1.03 REFERENCES

A. Latest version of American Society for Testing and Materials (ASTM) standards:

1. ASTM D 638. Test Method for Tensile Properties of Plastics.
2. ASTM D 790. Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
3. ASTM D 1238. Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer.
4. ASTM D 1248. Standard Specification for Polyethylene Plastics Molding and Extrusion Materials.
5. ASTM D 1505. Test Method for Density of Plastics by the Density-Gradient Technique.
6. ASTM D 1603. Standard Test Method for Carbon Black in Olefin Plastics.
7. ASTM D 1693. Standard Test Method for Environmental Stress-Cracking of Ethylene Plastics.

8. ASTM D 2122. Method for Determining Dimensions of Thermoplastic Pipes and Fittings.

9. ASTM D 2657. Standard Practice for Heat Joining Polyolefin Pipe and Fittings.

10. ASTM D 2837. Standard Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials.
ASTM D 3350. Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.

11. ASTM F 714. Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.

12. ASTM F 1055. Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene Pipe and Tubing.

B. Latest version of the American National Standards Institute (ANSI) standards:

1. ANSI B16.1. Standard Specifications for Cast-Iron Pipe Flanges and Flange Fittings.

1.04 SUBMITTALS

A. Submit the following to the Engineer for review not less than 30 calendar days prior to first installation of material under this section:

1. detailed shop drawings of all HDPE pipes, fittings, supports and other appurtenances;

2. a list of material to be furnished;

3. the names of the suppliers and the proposed dates of delivery of the materials to the site;

4. detailed procedures to be used for hydrostatic testing of the pipes and fittings;

5. documentation demonstrating that the manufacturer has adequate quality control procedures to ensure that fabrication of the HDPE pipes and fittings complies with the requirements of this Section;

6. origin (resin supplier's name, resin production plant) and identification (brand name, number) of the polyethylene resin used; and

7. certification of minimum values and the corresponding test procedures for HDPE material properties listed in Tables 02715-1 and 02712-2.

B. Submit at least 30 calendar days prior to installation of any material covered by this section, manufacturer's written certification of compliance with these Specifications for that material.

C. Submit at least 14 calendar days prior to installation, documentation of training and certification of personnel qualified for performing HDPE pipe joining operations.

1.05 CONSTRUCTION QUALITY ASSURANCE

A. The installation of HDPE pipe and fittings shall be monitored by the CQA Consultant as required by the CQA Plan.

B. The CQA Consultant may perform material conformance testing and installation quality assurance evaluations of the HDPE pipe and fittings.

C. The Contractor shall be aware of the activities required of the CQA Consultant by the CQA Plan and shall account for these activities in the installation schedule.

D. The Contractor shall correct all deficiencies and nonconformances identified by the CQA Consultant at no additional cost to the Owner.

PART 2 - PRODUCTS

2.01 GENERAL

A. Design and proportion all parts to have adequate strength and stiffness and to be adapted for the purposes shown on the Construction Drawings.

2.02 HDPE COMPOUND

A. Furnish HDPE flat stock manufactured for new HDPE resin conforming to ASTM D 1248 (Type III, Class C Category 5, Grade P34), ASTM D 3350 (minimum cell classification as shown in Table 02715-1), and having a Plastic Pipe Institute (PPI) Rating of PE 3408. Furnish material having minimum certifiable property values listed in Table 02715-1.

B. Furnish HDPE pipe and fittings manufactured from new HDPE resin conforming to ASTM D 1248 (TYPE III, Class C Category 5, Grade P34), ASTM D 3350 (minimum cell classification as shown in Table 02715-2), and having a Plastic Pipe Institute (PPI) Rating of PE 3408. Furnish material having minimum certifiable property values listed in Table 02715-2.

2.03 HDPE PIPES AND FITTINGS

A. Unless otherwise shown on the Construction Drawings, furnish HDPE pipe and fittings that have a SDR of 11 and conform to ASTM F 714.

B. Furnish HDPE pipes in standard laying lengths not exceeding 50 feet.

C. Furnish HDPE pipes and fittings that are homogeneous throughout and free of visible cracks, holes (other than intentional manufactured perforations), foreign inclusions, or other deleterious effects, and are uniform in color, density, melt index, and other physical properties.

D. Furnish HDPE end caps at the end of pipes as shown on the Construction Drawings.

E. Furnish electrofusion couplings meeting the requirements of ASTM F 1055 and as recommended by the electrofusion coupling manufacturer.

F. Perforate pipe by factory drilling at locations shown on the Construction Drawings.

2.04 IDENTIFICATION

A. Continuously indent print on the HDPE pipe, or space at intervals not exceeding 5 feet the following:

1. name and/or trademark of the HDPE pipe manufacturer;

2. nominal HDPE pipe size;

3. standard dimension ratio (e.g., SDR-11);

4. the letters PE followed by the polyethylene grade per ASTM D 1248, followed by the Hydrostatic Design Stress in 100's of psi (e.g., PE 3408);

5. Manufacturing Standard Reference (e.g., ASTM F 714); and

6. a production code from which the date and place of manufacture can be determined.

2.05 EMBEDMENT FILL AND BACKFILL MATERIALS

A. Furnish embedment fill materials in accordance with Section 02215.

B. Furnish trench backfill materials in accordance with Section 0215.

PART 3 - EXECUTION

3.01 GENERAL

A. Perform HDPE pipe joining operations with trained and certified personnel.

3.02 HDPE PIPE, FITINGS, AND APPURTENANCES

A. Deliver HDPE pipe, fittings, and appurtenances to the site at least 10 calendar days prior to the planned installation date.

B. Provide proper handling and storage of the HDPE pipe, fittings, and appurtenances at the site. Protect materials from excessive heat or cold, dirt, moisture, cutting, or other damaging or deleterious conditions. Provide any additional storage procedures required by the Manufacturer.

C. Exercise care when transporting, handling, and placing HDPE pipe and fittings. Use rope, fabric, or nylon slings and straps when handling HDPE pipe. Do not position slings, straps, at butt-fusion joints or at fittings.

D. The maximum allowable depth of cuts, gouges or scratches on the exterior surface of HDPE pipe, fittings, or appurtenances is 10 percent of the wall thickness. The interior of the pipe and fittings shall be free of cuts, gouges and scratches. Replace any HDPE pipe fittings that become gouged, twisted, or crimped. Remove from the work area damaged pipes and fittings.

E. Whenever pipe laying is not actively in progress, close the open ends of all installed pipes using water tight plugs.

F. Perform trenching and backfilling of all installed pipe, fittings, and appurtenances in accordance with Section 02215.

G. Perform testing of all installed pipe, fittings, and appurtenances in accordance with this section.

3.03 HDPE PIPE AND FITTINGS INSTALLATION

A. Carefully examine HDPE pipe and fittings for cracks, damage or defects before installation. Do not use cracked, damaged, or defective material.

B. Inspect the interior of al pipe and fittings and remove any foreign material from the pipe interior before the pipe is moved into final position.

C. Perform field-cutting of pipes, where required, with a machine specifically designed for cutting pipe. Make cuts carefully without damage to pipe, so as to leave a smooth end at right angles to the axis of pipe. Taper cute ends and smooth sharp edges. Flame cutting is not allowed.

D. Do not lay pipe until the CQA Consultant has verified the bedding conditions.

E. Install HDPE pipe and fittings in accordance with the Manufacturer's recommendations and the requirements of this Section.

F. Install pipe and fittings to the lines and grades shown on the construction Drawings.

G. Place the compact embedment fill and trench backfill material as shown on the Construction Drawings and in accordance with Section 02215.

H. Provide all necessary adapters and/or fittings required when connecting different types and sizes of pipe or when connecting pipe made by different manufacturers.

3.04 HDPE PIPE, FITTINGS, AND APPURTENANCES CONNECTIONS

A. Personnel performing jointing operations shall demonstrate proficiency to the satisfaction of the CQA Consultant.

B. Weather Conditions for Joining:

1. Do not join HDPE pipes and fittings at ambient temperature below 40 degrees Fahrenheit (°F) or above 104 °F, unless authorized in writing by the Construction Manager. For cold (<40 °F) or hot (104 °F) weather joining, use the additional procedures authorized in writing by the Construction Manager.

2. Measure ambient temperatures at fusion machine.

3. Do not join HDPE pipe and fittings during any precipitation, in the presence of heavy for or dew, or in areas of ponded water.

C. Prior to joining, clean the joint area to be free of moisture, dust, dirt, debris of any kind, and foreign material.

D. Joining equipment shall be approved for the applicable field joining processes. Fusion-welding apparatus shall be an automated device equipped with gauges giving the applicable temperatures and pressures.

E. Join HDPE pipe with thermal butt-fusion joints or electrofusion adapters. Fabricate joints in compliance with ASTM D 2657, ASTM F 1055, the manufacturer's recommendations, and the requirements of this section.

F. Install flanged connections of HDPE pipe and fittings as shown on the Construction "Drawings and as follows:

1. Thermally butt-fuse HDPE flanged connection (flange adapter) to HDPE pipe.
2. Use Type 316 stainless steel lap joint flange. Outside diameter and drillings shall comply with American National Standards Institute (ANSI) B16.1.
3. Use Type 316 stainless steel flange bolts, nuts and washer that meet the requirements of ANSI B16.1. Lubricate bolt threads prior to attaching nuts. Tighten bolts to a torque of 100 ±5 foot-pounds.

G. Bolt HDPE flange adapter and stainless steel lap joint flanges at the ambient temperature of the surrounding soil to prevent relaxation of the flange bolts and loosening of the joint due to thermal contraction of the polyethylene. Draw bolts up evenly and inline. Retighten bolts 1 and 4 hours after initial tightening.

3.05 FIELD TESTING AND INSPECITON

A. All non-perforated pipe and fittings shall be pressure tested prior to placing fill over the pipe.

B. All tests shall be performed in the presence of the CQA Consultant. Notify the CQA Consultant a minimum of 24 hours in advance of pipe testing or pipe inspection.

C. HDPE pipe with thermal butt-fusion type joints shall be hydrostatically tested at 60 psi internal pressure.

D. Test duration shall be a minimum of three hours after the pressure in the pipe stabilizes. The test duration does not include the initial expansion phase after

the pipe is first pressurized. The duration of the expansion phase will be in accordance with the pipe Manufacturer's recommendations.

E. Criteria for acceptance of the pressure-test results shall be established using the pipe Manufacturer's recommendations. Criteria must be approved by the Engineer.

F. Inspect fusion joints for evidence of excess or insufficient bead size, contamination, offset, or any other evidence of inadequate joining. The surface of the HDPE pipe shall be clean at the time of inspection. Wipe or wash the HDPE pipe surface if surface contamination inhibits inspection.

3.05 REPAIRS

A. Installed pipes or pipe joints that leak, according to the test results, shall be either repaired to the satisfaction of the CQA Consultant or replaced.

B. Repaired or replaced pipe shall be successfully pressure-tested prior to filling over the pipe.

3.06 SURVEY CONTROL

A. Survey the top of HDPE pipe at each change in direction or grade and on no greater than 50-foot centers and at all manhole inlets and outlets in accordance with Section 02100.

3.07 TOLERANCES

A. Install all HDPE pipes to within ±0.1 feet of bottom of pipe elevations as indicated on the construction Drawings.

B. Provide positive slope of gravity liens at all locations to within ±10 percent of the values indicated on the Construction Drawings.

TABLE 02715-1

REQUIRED HDPE FLAT STOCK PROPERITES
ASTM D 3350 CELL CLASSIFICATION PROPERTIES AND RANGES

Properties	Cell Range	Qualifiers	Units	Specified Values	Test Method
Specific Gravity	3	minimum	N/A	0.94	ASTM D 1505
Melt flow Index	3 to 5	maximum	g/10 min	<0.4	ASTM D 1238 (Condition E)
Flexural Modulus	5	minimum	lb/in^2	110,000	ASTM D 790
Tensile Strength	4 to 5	minimum	lb/in^2	3,000	ASTM D 638
Environmental Stress Crack	3	minimum	hrs	F_{20}>192	ASTM D 1693
Hydrostatic Design Basis at 73°F	4	minimum	lb/in^2	1,600	ASTM D 2837
UV Stabilizer	C	minimum	% Carbon Black	2	ASTM D 1603

TABLE 02715-2

REQUIRED HDPE PIPE AND FITTINGS PROPERTIES
ASTM D 3350 CELL CLASSIFICATION PROPERITES AND RANGES

Properties	Cell Range	Qualifiers	Units	Specified Values	Test Method
Specific Gravity	3	minimum	N/A	0.94	ASTM D 1505
Melt flow Index	4 to 5	maximum	g/10 min	<0.15	ASTM D 1238 (Condition E)
Flexural Modulus	5	minimum	lb/in^2	110,000	ASTM D 790
Tensile Strength	4 to 5	minimum	lb/in^2	3,000	ASTM D 638
Environmental Stress Crack	3	minimum	hrs	F_{20}>192	ASTM D 1693
Hydrostatic Design Basis at 73°F	4	minimum	lb/in^2	1,600	ASTM D 2837
UV Stabilizer	C	minimum	% Carbon Black	2	ASTM D 1603

[END OF SECTION]

SECTION 02720

GEOTEXTILES

SECTION 02720

GEOTEXTILES

PART 1 - GENERAL

1.01 SCOPE

A. This Section includes geotextile production and installation.

1.02 RELATED SECTIONS AND PLANS

A. Section 02215 - Trenching and Backfilling

B. Section 02235 - Granular Drainage Materials

C. Section 02245 - Riprap

D. Construction Quality Assurance (CQA) Plan

1.03 REFERENCES

A. Latest version of American Society for Testing and Materials (ASTM) Standards:

1. ASTM D 4355. Standard Test Method for Deterioration of Geotextiles from Exposure to Ultraviolet Light and Water.

2. ASTM D 4491. Standard Test Method for Water Permeability of Geotextiles by Permittivity.

3. ASTM D 4533. Standard Test Method for Trapezoid Tearing Strength of Geotextiles.

4. ASTM D 4632. Standard Test Method for Breaking Load and Elongation of Geotextile.

5. ASTM D 4751. Standard Test Method for Determining Apparent Opening Size of a Geotextile.

6. ASTM D 4833. Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products.

7. ASTM D 4873. Standard Test Method for Identification, Storage, and Handling of Geotextiles.

8. ASTM D 5261. Standard Test Method for Measuring Mass Per Unit Area of Geotextiles.

9. ASTM D 5493. Standard Practice for Permittivity of Geotextiles Under Load.

10. ASTM D 6241. Standard Test Method for the Static Puncture Strength of Geotextiles and Geotextile Related Products Using a 50-mm Probe.

B. Federal Standard No. 751a – Stitches, Seams, and Stitching.

1.04 SUBMITTALS

A. Submit the following to the Engineer for review not less than 21 calendar days prior to use:

1. geotextile Manufacturer and product name;

2. certification of minimum average roll values and the corresponding test procedures for all geotextile properties listed in Tables 02720-1 and 02720-2; and

3. projected geotextile delivery dates.

B. Submit to the Engineer for review at least 14 calendar days prior to geotextile placement, manufacturing quality control certification for each roll of geotextile as specified in this Section.

1.05 CONSTRUCTION QUALITY ASSURANCE

A. The installation of geotextiles will be monitored by the CQA Consultant as required by the CQA Plan.

B. The CQA Consultant may perform material conformance testing of geotextiles as required in the CQA Plan.

C. The Contractor shall be aware of the activities required of the CQA Consultant by the CQA Plan and shall account for these activities in the construction schedule.

D. The Contractor shall correct all deficiencies and nonconformances identified by the CQA Consultant at no additional cost to the Owner.

PART 2 - PRODUCTS

A.01 GEOTEXTILE

A. Furnish geotextile products with minimum average roll values (95 percent lower confidence limit) meeting or exceeding the required property values in Tables 02720-1 (for geotextile filters) and 02720-2 (for geotextile separators).

B. Furnish geotextiles that are stock products.

C. Furnish geotextiles that are manufactured from first quality polymers, with not more than 20 percent reclaimed polymer used in production.

D. Furnish polymer threads for stitching that are ultra-violet (UV) light stabilized to at least the same requirements as the geotextile to be sewn. Furnish polyester or polypropylene threads that have a minimum size of 2,000 denier.

A.02 MANUFACTURING QUALITY CONTROL

A. Sample and test the geotextile to demonstrate that the material conforms to the requirements of this Section.

B. Perform manufacturing quality control tests to demonstrate that the geotextiles' properties conform to the values specified in Tables 02720-1 and 02720-2. Perform as a minimum, the following manufacturing quality control tests at a minimum frequency of once per 50,000 ft^2:

Test	Procedure
Mass per unit area	ASTM D 5261
Grab strength	ASTM D 4632
Tear strength	ASTM D 4533
Puncture strength	ASTM D 4833 or ASTM D 6241

C. Perform additional manufacturing quality control tests on the geotextile filter at a minimum frequency of once per 100,000 ft^2, to demonstrate that it's apparent opening size (ASTM D 4751) and permittivity (ASTM D 4491) conform to the values specified in Table 02720-1.

D. Submit quality control certificates signed by the geotextile manufacturer quality control manager. The certificates shall state that the geotextiles are continuously inspected and are needle-free. The quality control certificates shall also include: lot, batch, and roll number and identification; and results of manufacturing quality control tests including description of test methods used.

E. Do not supply any geotextile roll that does not comply with the manufacturing quality control requirements.

F. If a geotextile sample fails to meet the quality control requirements of this Section, sample and test rolls manufactured at the same time or in the same lot as the failing roll. Continue to sample and test the rolls until the extent of the failing rolls are bracketed by passing rolls. Do not supply failing rolls.

A.03 PACKAGING AND LABELING

A. Supply geotextiles in rolls wrapped in relatively impermeable and opaque protective wrapping. Wrapping which becomes torn or damaged shall be repaired with similar materials.

B. Mark or tag geotextile rolls in accordance with ASTM D 4873 with the following information:
   1. manufacturer's name;
   2. product identification;
   3. lot or batch number;
   4. roll number; and
   5. roll dimensions.

C. Geotextile rolls not labeled in accordance with this Section or on which labels are illegible upon delivery to the site shall be rejected and replaced at no expense to the Owner.

2.04 TRANSPORTATION

A. Deliver geotextiles to the site at least 14 calendar days prior to the planned deployment date to allow the CQA Consultant adequate time to perform conformance testing on the geotextile samples as described in the CQA Plan.

2.05 HANDLING AND STORAGE

A. Protect geotextiles from sunlight, moisture, excessive heat or cold, puncture, mud, dirt, and dust or other damaging or deleterious conditions. Follow all geotextile manufacturer recommendations for handling and storage.

B. Store geotextile rolls on palates or other elevated structures. Do not store geotextile rolls directly on the ground.

C. Outdoor storage of geotextile rolls shall not exceed the manufacturer's recommendation or longer than 6 months, whichever is less.

PART 3 - EXECUTION

3.01 PLACEMENT

A. Do not commence geotextile installation until the CQA Consultant completes conformance evaluation of the geotextiles and performance evaluation of previous work, including evaluation of Contractor's survey results for previous work.

B. Handle geotextiles so as to ensure they are not damaged in any way.

C. Take necessary precautions to prevent damage to underlying layers including rutting during placement of the geotextiles.

D. After unwrapping the geotextiles from its opaque cover, do not leave them exposed for a period in excess of 15 calendar days or for the Manufacturer's written recommended exposure policy.

E. If white colored geotextiles are used take precautions against "snowblindness" of personnel.

F. Examine the geotextile surface after installation to ensure that no potentially harmful foreign objects are present. Remove any such objects and replace any damaged geotextiles.

3.02 SEAMS AND OVERLAPS

A. Continuously overlap a minimum of 6 in. and sew filter geotextiles (i.e., spot sewing is not allowed) using a "single prayer" seam. Sew seams using Stitch type 401 as per Federal Standard No. 751a. In lieu of sewing, geotextile filters may be overlapped a minimum of two feet.

B. Do not install horizontal seams on slopes that are steeper than 10 horizontal to 1 vertical. Seams shall be along, not across, the slopes.

C. Overlap separator geotextiles a minimum of 12 in. and ensure that the overlap is maintained.

3.03 REPAIR

A. Repair any holes or tears in the geotextiles using a patch made from the same geotextile material. Extend geotextile patches a minimum of 1 ft beyond the damaged area. Sew geotextile patches into place no closer than 1 in. from any panel edge. Should any tear exceed 50 percent of the width of the roll, remove and replace that roll.

B. Remove any soil or other material that may have penetrated and torn geotextiles.

3.04 PLACEMENT OF SOIL MATERIALS

A. Place soil materials on top of geotextiles in such a manner as to ensure that:
   1. the geotextiles and the underlying materials are not damaged; and
   3. slippage does not occur between the geotextile and the underlying layers during placement.

B. Spread soil on top of the geotextile to cause the soil to cascade over the geotextile rather than be shoved across the geotextile.

C. Place aggregate over geotextile separators as indicated on the Construction Drawings prior to trafficking.

D. Place soil over geotextile filters as indicated on the Construction Drawings prior to trafficking.

TABLE 02720-1

REQUIRED PROPERTY VALUES FOR GEOTEXTILE FILTER

PROPERTIES	QUALIFIERS	UNITS	SPECIFIED VALUES[1]	TEST METHOD
Type				
Nonwoven needlepunched				(-)
Polymer composition	minimum	%	95 polypropylene or polyester by weight	(-)
Mass per unit area	minimum	oz/yd^2	7	ASTM D 5261
Filter Requirements				
Apparent opening size (O_{95})	maximum	mm	0.21	ASTM D 4751
Permittivity	minimum	sec^{-1}	0.5	ASTM D 4491
Mechanical Requirements				
Grab strength	minimum	lb	180	ASTM D 4632[2]
Tear strength	minimum	lb	75	ASTM D 4533[3]
Puncture strength	minimum	lb	75	ASTM D 4833[4]
Burst strength	minimum	psi	350	ASTM D 3786
Durability				
Ultraviolet Resistance	minimum	%	70	ASTM D 4355

Notes:

(1) All values represent minimum average roll values.
(2) Minimum of values measured in machine and cross machine directions with 1 inch clamp on Constant Rate of Extension (CRE) machine.
(3) Minimum value measured in machine and cross machine direction.
(4) Tension testing machine with a 1.75-in. diameter ring clamp, the steel ball being replaced with 0.31-in. diameter solid steel cylinder with flat tip centered within the ring clamp.
(5) mm = millimeter
% = percent
oz/yd^2 = ounce per square yard
sec = second
lb = pound
psi = pound per square inch

TABLE 02720-2

REQUIRED PROPERTY VALUES FOR GEOTEXTILE SEPARATOR

PROPERTIES	QUALIFIERS	UNITS	SPECIFIED VALUES[1]	TEST METHOD
Type				
Nonwoven needlepunched				(-)
Polymer composition	minimum	%	95 polypropylene or polyester by weight	(-)
Mass per unit area	minimum	oz/yd^2	8	ASTM D 5261
Mechanical Requirements				
Grab strength	minimum	lb	180	ASTM D 4632[2]
Tear strength	minimum	lb	75	ASTM D 4533[3]
Puncture strength	minimum	lb	75	ASTM D 4833[4]
Burst strength	minimum	psi	350	ASTM D 3786
Durability				
Ultraviolet Resistance	minimum	%	70	ASTM D 4355

Notes:

(1) All values represent minimum average roll values.
(2) Minimum of values measured in machine and cross machine directions with 1 inch clamp on Constant Rate of Extension (CRE) machine.
(3) Minimum value measured in machine and cross machine direction.
(4) Tension testing machine with a 1.75-in. diameter ring clamp, the steel ball being replaced with 0.31-in. diameter solid steel cylinder with flat tip centered within the ring clamp.
(5) % = percent
oz/yd^2 = ounce per square yard
lb = pound
psi = pound per square inch

[END OF SECTION]

SECTION 02920

VEGETATIVE LAYER

SECTION 02920

VEGETATIVE LAYER

PART 1 - GENERAL

1.01 SCOPE

A. This Section includes vegetative layer material and placement.

1.02 RELATED SECTIONS AND PLANS

A. Section 02200 - Earthwork

B. Section 02930 - Vegetation

C. Construction Quality Assurance (CQA) Plan

1.03 REFERENCES

A. Latest version of American Society for Testing and Materials (ASTM) Standards:

1. ASTM D 422.Standard Method for Particle-Size Analysis of Soils.

2. ASTM D 2487. Classification of oils for Engineering Purposes (Unified Soil Classification System)

3. ASTM D 2974. Standard Test Methods for Moisture, Ash, and Organic Matter of Peat and Other Organic Soil.

4. ASTM D 4972. Standard Test Method for Determination of pH of Soils.

1.04 SUBMITTALS

A. For each on-site/off-site vegetative layer source, submit the following to the Engineer for review and approval within 30 calendar days from Notice to Proceed:

1. the source of the vegetative layer;

2. test results conducted on samples from borrow stockpile in accordance with ASTM D 422, ASTM D 2487, ASTM D 2974, and ASTM D 4972; and

3. a 50-pound representative sample of the vegetative layer.

1.05 CONSTRUCTION QUALITY ASSURANCE

A. The placement of the vegetative layer will be monitored by the CQA Consultant, as require by the CQA Plan.

B. CQA consultant will perform soil conformance testing on the vegetative layer material to establish compliance with this Section. Conformance testing to be performed and testing frequencies are given in the CQA Plan.

B. The Contractor shall be aware of the activities required of the CQA Consultant by the CQA Plan and shall account for these activities in the construction schedule.

C. The Contractor shall correct all deficiencies and nonconformances identified by the CQA Consultant at no additional cost to the Owner.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Obtain vegetative layer material from on-site/off-site borrow sources. The CQA Consultant will perform conformance testing on material submitted under this Section.

B. Furnish vegetative layer material meeting the following material requirements.

1. Material shall be a loamy soil, classified as ML, SC, or SM (per ASTM D 2487), and be loose and friable. For vegetative layer to be considered loamy, that fraction passing the U.S. Standard No. 10 sieve shall contain not more than 40 percent clay-sized fraction, as determined in accordance with ASTM D 422.

2. Vegetative layer shall be free of deleterious materials.

3. Vegetative layer shall contain not less than 5 percent nor more than 20 percent organic matter as determined by loss on ignition of samples oven dried to constant weight (per ASTM D 2974, Method A for moisture content determination and Method C for ash content determination). The vegetative layer may be amended as approved in writing by the Engineer if the organic content is less than five percent.

4. The pH of the vegetative layer material shall not be less than 5.5 and not more than 7.

C. Based on test performed, the Engineer shall identify the vegetative layer as acceptable, acceptable with certain fertilizers and limestone applications, or unacceptable. IF the vegetative layer is found acceptable, but requiring lime or fertilizer, the fertilizer and lime requirements will be met as specified in Section 02930 or as recommended by the Engineer. If the vegetative layer material is found unacceptable, the Contractor shall be responsible for identifying another source of vegetative layer material and shall incur all expenses associated with testing additional samples. All vegetative layer material incorporated into the site work shall match the sample provided to the Engineer for testing.

D. Obtain water for moisture conditioning vegetative layer from the on-site water source as directed by the Engineer.

2.02 EQUIPMENT

A. Furnish, operate, and maintain equipment necessary to transport, place, and prepare vegetative layer material.

PART 3 - EXECUTION

3.01 PLACEMENT

A. Do not commence placement of vegetative layer material until CQA Consultant completes conformance evaluation of vegetative layer material and performance testing of previous work, including evaluation of the Contractor's survey results of previous work.

B. Prior to spreading the vegetative layer, scarify or otherwise loosen the top surface of the existing soil layer to a minimum depth of 1 inch. Scarify using a disc harrow, rake, dozer, or other suitable means.

C. Construct vegetative layer to the thickness, elevations, and limits indicated on the Construction Drawings. Round breaks between slopes.

D. Place vegetative layer material over approved areas, spread and track lightly so that the equipment grouser marks are perpendicular to the direction of flow.

E. Place and spread vegetative layer material to a depth sufficiently greater than required so that after light tracking and natural settlement, the completed work will conform to the thickness requirement indicated on the Construction

Drawings.

F. Do not spread vegetative layer material in water. If soil or weather conditions are unsuitable, as determined by the Engineer, cease placing vegetative layer until permission to resume vegetative layer operations is obtained form the Engineer.

G. After vegetative layer has been placed and spread, remove stiff clods, lumps, roots, litter, and other foreign material. Remove stiff clods larger than 3 inches in diameter or reduce in size by raking, discing, or other processing.

H. Within 72 hours of the completion of the placement of vegetative layer in an area, vegetate the area in accordance with Section 02930.

I. Repair any erosion or washout of the vegetative layer in an area, vegetate the area in accordance with Section 02930.

3.02 SURVEY CONTROL

A. Survey the limits and elevations of the top surface of the vegetative layer in accordance with Section 02100.

3.03 TOLERANCE

A. Construct the vegetative layer to within ±0.1 feet of the thickness shown on the Construction Drawings.

B. Construct the vegetative layer to within +0.5 feet of the elevations indicated on the Construction Drawings.

[END OF SECTION]

SECTION 02930

VEGETATION

SECTION 02930

VEGETATION

PART 1 - GENERAL

1.01 SCOPE

A. This Section includes sodding, seeding, liming, fertilizing and maintaining vegetation until established and accepted.

1.02 RELATED SECTIONS AND PLANS

A. Section 02100 - Surveying

B. Section 02200 - Earthwork

C. Section 02920 - Vegetative Layer

D. Construction Quality Assurance (CQA) Plan

1.03 REFERENCES

A. Latest version of engineering standards from the Departmento de Transportación y Obras Publicas, Manual de Diseño (DTOP Specifications).

1.04 SUBMITTALS

A. Submit the following to the Engineer not less than 30 calendar days prior to sue for review:

1. proposed type and source of sod and seed; and

2. manufacturer's product data for commercial fertilizer and lime and the recommended methods of application.

B. Submit a plan for handling and storage of materials to prevent damage by moisture, heat, or exposure. Include all recommendations of manufacturers and suppliers.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Sod shall be live, thriving, and meet the applicable requirements of the DTOP Specifications.

B. Seeds shall be live seed.

C. The seed shall have been harvested from the previous year's crop.

D. All seed bags shall have a label attached stating the date of harvest, Lot number, percent purity, percent germination, noxious weed verification, and date of test.

E. Use fertilizer that is dry or liquid commercial grade fertilizer uniform in composition that meets the requirements of all State and Federal regulations and standards of the Association of Agricultural Chemists. Deliver fertilizer to the site in original, properly labeled, unopened, clean, containers each showing the manufacturer's guaranteed analysis conforming to applicable fertilizer regulations and standards. Use fertilizer that is 16-4-8 or as modified by the Engineer based on testing of the topsoil by the CQA Consultant. Apply fertilizer to all seeded areas.

F. Use lime that is agricultural ground limestone with a minimum total neutralizing power of 90 percent. The lime shall have a gradation of at least 40 percent passing the U.S. Standard Number 100 sieve, and at 95 percent passing the U.S. Standard Number 8 sieve.

PART 3 - EXECUTION

3.01 PLANTING AND APPLICATON OF FERTILIZER

A. Do not commence vegetation until the Engineer reviews the results of soil analyses.

B. Notify the Engineer 24 hours prior to laying sod, seeding, or fertilizing.

C. The seed and fertilizer shall be placed by hydro seeding, or other method approved by the Engineer.

D. The underlying vegetative layer should be graded to the lines and limits as indicated on the Construction Drawings. The vegetative layer surface shall be scarified and damp immediately prior to the seed placement.

E. Repair all gullies, washes, or disturbed areas that develop subsequent to final dressing of the prepared surface.

F. Seeded areas shall be watered after germination as necessary until the vegetation is well established.

G. Apply fertilizer and lime to all areas where sod is to be placed unless otherwise indicated by the Engineer.

H. Apply fertilizer and lime at the specified rates. If not applied hydraulically, thoroughly rake the fertilizer and lime into the prepared surface to a minimum depth of 2 inches.

I. Application rates:

1. Application rates for seeding shall be according to manufacture/supplier recommendations or as directed by the Engineer.

2. Application rates for fertilizer and lime in this section may be adjusted after the results of the site soil test results performed by the CQA Consultant are available.

3. Base contract price on application rates for fertilizer and lime specified in this section. Contract price will be adjusted for any variations either decreasing or increasing the application rates.

J. For areas to be covered with seed:

1. Apply fertilizer at a uniform rate of 1,200 pounds per acre or as otherwise directed by the Engineer.

2. Apply agricultural lime at a rate of two tons per acre or as otherwise directed by the Engineer.

3.02 MAINTENANCE

A. Maintain seed areas immediately after placement until vegetation is well established and exhibits a vigorous growing condition.

B. The Contractor shall supply and apply supplemental irrigation for the maintenance period following the placement of the seed. All seeded areas should receive a minimum of 1½ in. of water per week either by precipitation or supplemental irrigation.

C. Maintain the seeded areas in satisfactory condition. Maintenance of the seeded areas includes repairing eroded areas, revegetating, watering, and mowing (if applicable). A satisfactory condition of seeded are is defined as a 10,000 square feet section of turf that has no bare spots larger than three square feet.

D. The inspection will be performed by the Engineer, who will determine whether repair of sodded areas or revegetation is required.

3.03 ACCEPTANCE

A. The vegetated areas shall be accepted at the end of the warranty period if a satisfactory condition as defined in this Section exists.

3.04 WARRANTY PERIOD

A. Vegetated areas shall be subject to a warranty period of the completion of the Contract or not less than 2 full growing seasons from initial establishment of permanent vegetation, whichever is greater, over 100 percent of the areas seeded.

B. At the end of the warranty period, the Engineer will perform an inspection upon written request by the Contractor. Vegetated areas not demonstrating satisfactory condition of vegetation as outlined above, shall be repaired, resodded, and maintained to meet all requirements as specified herein at the Contractor's expense.

C. After all necessary corrective work has been completed, the Engineer will certify in writing the final acceptance of the vegetated areas.

[END OF SECTION]

SECTION 03100

CAST-IN-PLACE CONCRETE

SECTION 03100

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 SCOPE

A. This Section specifies cast-in-place concrete, including form work, reinforcement, mix design, placement procedures, and finishes.

B. Cast-in-place concrete includes the following:

1. foundations and footings;
2. Slabs-on-grade;
3. Equipment pads and bases;
4. Concrete boxes; and
5. Retaining walls;

1.02 RELATED SECTIONS AND PLANS

A. Construction Quality Assurance (CQA) Plan

B. Construction Drawings

1.03 REFERENCES

A. The publications listed below, latest revision applicable, form a part of this Specification to the extent referenced in this Section:

1.	ACI 301	(American Concrete Institute) Specifications for Structural Concrete
2.	ACI 304	Guide for Measuring, Mixing, Transporting, and Placing Concrete.
3.	ACI 305	Hot Weather Concreting.
4.	ACI 309	Guide for Consolidation of Concrete.
5.	ACI 315	Manual of Standard Practice for Detailing Reinforced Concrete Structures.
6.	ACI 332R	Chapter 11, Repair of Surface Defects.

7. ASTM A 82. (American Society for Testing and Materials) Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
8. ASTM C 94. Standard Specification for Ready-Mixed Concrete.
9. ASTM C 143. Standard Test Method for Slump of Hydraulic Cement Concrete.
10. ASTM C 150. Standard Specification for Portland Cement.
11. ASTM C 171. Standard Specification for Sheet Materials for Curing Cement.
12. ASTM C 172. Standard Specification for Sampling Freshly Mixed Concrete.
13. ASTM C 618. Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
14. ASTM C 1064. Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete.

1.04 CONSTRUCTION QUALITY ASSURANCE REQUIREMENTS

A. The work described in this Section shall be monitored by the CQA Consultant in accordance with the requirements of the CQA Plan.

B. The CQA Consultant will perform conformance and performance testing in accordance with this Section and the CQA Plan.

1.05 SUBMITTALS

A. Submit proposed design mixed for each different type and strength of concrete to be used to construction Manager for approval a minimum of two weeks prior to concrete placement. Provide separate mix designs for changes in ingredients. Include the following items:

1. Mix proportions for all ingredients of the mix;
2. Designate within the submittal where each mix is proposed to be used;
3. Cement type;
4. Aggregate gradations taken within 3 months from the date of submission;
5. Specify size of coarse aggregate in accordance with ASTM size numbers;
6. Product data for all proprietary items incorporated into the mix including, but not limited to admixtures; and

7. Compressive strength results from an independent testing laboratory for mixes designed in accordance with trail batch or field experience methods.

B. Submit to Construction Manager for approval at least two weeks prior to concrete placement product data for proprietary materials and items, including reinforcement and forming accessories, admixtures, patching compounds, waterstops, joint systems, curing compounds, and others if installed.

C. For concrete elements not detailed on the Permit Drawings, Shop Drawings shall be prepared for reinforcement detailing fabricating, bending, and placing concrete reinforcement. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures" showing bar schedules, bent bar diagrams, and arrangement of concrete reinforcement shall be submitted to Construction Manager for approval at least two weeks prior to concrete placement.

D. The mix designs and Shop Drawings shall be endorsed by a Civil Engineer licensed in State of New York.

1.06 AS-BUILT DOCUMENTATION

At a minimum, as built documentation shall identify the horizontal and vertical location of the corners of each cast-in-place product.

1.07 CONSTRUCTION QUALITY CONTROL

A. General

1. The Contractor shall be responsible for performing the tests described in this Section and for performing such inspection as are deemed necessary by the contractor to demonstrate compliance with the requirements of this Section.

2. The Contractor shall provide sufficient personnel and supervision to monitor and document the work covered by this Section.

3. The Contractor shall provide reasonable use of on-site equipment and labor to assist Construction Manager and CQA Consultant in performing inspections and obtaining conformance samples for independent testing from stockpiles, borrow areas, and completed work. CQA Consultant will perform such inspections, monitoring, and testing in a timely manner that it does not impede the progress of the Contractor. Construction Manager

will be responsible to coordinate inspection, testing, and monitoring requirements with the CQA Consultant.

B. Inspection

1. Before placing concrete, the Contractor shall inspect, the completed formwork installation, reinforcing steel, items to be embedded, black outs and openings.

2. Certification shall be provided from the steel manufacturer that confirms that the grade and quality of steel used meets or exceeds the grade and quality required by this Section.

C. Testing

The Contractor shall employ and independent testing agency approved by Construction Manager to perform tests and to submit test reports for the concrete testing required in this Section. Sampling and testing for quality control during concrete placement shall include the following.

1. Sampling Fresh Concrete: Sample in accordance with ASTM C 172, except modified for slump to comply with ASTM C 143.

   a. Slump: ASTM C 143; one test at point of discharge for each day's port of each type of concrete.

   b. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 30 degrees C and above, and one test for each set of compressive-strength specimens.

   c. Compression Test Specimen: one set of six 6-in. by 6-in. by 6-in. cubes for each compressive-strength test, unless otherwise directed. Mold and store cubes for laboratory-cured test specimens except when field-cured test specimens are required.

   d. Compressive-Strength Tests: one set for each day's pour exceeding 5 cubic yd of each concrete grade placed in any one day; three specimens tested at 7 days and three specimens tested at 28 days after casting.

2. When frequency of testing provides fewer than five strength tests for a given class of concrete, conduct testing from at least five randomly selected batches or from each batch if fewer than five are used.

3. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength and no individual strength test result falls below the specified compressive strength by more than 6 psi.

4. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance

E. Documentation

1. All documentation associated with cast-in-place concrete shall be organized by activity in chronological order. It shall be legible, organized and easily accessible. All documentation is subject to auditing.

2. Test Results: The Contractor shall report test results in writing to Construction Manager within 2 working days after receiving test results from the independent testing agency.

3. Reports of compressive strength tests shall contain the project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength , and type of break for both 7-day tests and 28-day tests.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Form Materials

1. Forms shall be constructed of plywood, lumber, metal, or other acceptable material. Forms shall be furnished in the largest practicable sizes to minimize number of joints.

2. Form Release Agent: Provide commercial formulation water-based form release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces. Form release agents shall not contain volatile organic compounds (VOCs).

3. Form Ties: Factory-fabricated, adjustable-length, removable or snap-off metal form ties designed to prevent form deflection and to prevent spalling of concrete upon removal. Provide units that leave no metal

closer than 25 mm to the plane of the exposed concrete surface. Proved ties that, when removed, leave holes not larger than 25mm in diameter in the concrete surface.

B. Reinforcing Materials

1. All reinforcement material: New and free from scale, rust, or coatings that reduce bond to concrete.

2. Reinforcing Bars: Grade 460 deformed reinforcing bars.

3. Steel Wire: plain, cold-drawn steel.

4. Welded Wire Fabric: welded steel wire fabric.

5. Supports for Reinforcement: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Use wire bar-type supports complying with approved specifications.

C. Concrete Materials

1. Portland Cement: ASTM C 150, Type 1.

   a. Use one brand of cement throughout project unless otherwise approved by Construction Manager.

2. Fly Ash: ASATM C 618, Type F.

3. Aggregates: Aggregates shall comply with NYDOT specifications

   a. Do not sue fine or coarse aggregates that contain substances that cause spalling.

   b. Under no circumstances shall limestone be used as aggregate. Aggregates shall be of granitic origin.

   c. Fine aggregate shall be hard, clean, well-graded natural sand free from harmful quantities of clay and silt, saline and vegetable impurities and other deleterious matter. Fine aggregate shall be within the following grading limits per NYDOT Specifications.

   d. Coarse aggregate shall be sound, hard, clean particles free from harmful quantities of clay, crusher dust, organic impurities or

other deleterious matter. Coarse aggregate shall be within the following grading limits, unless otherwise specified in NYDOT.

4. Water: Potable, clean and free of deleterious substances.

C. Related Materials

1. Waterstops

a. Bentonite clay waterstops: Use only waterstops approved by Construction Manager for embedding in concrete to prevent passage of fluids through joints. Use factory fabricated corners, intersections, and directional changes.

2. Moisture-Retaining Cover: One of the following, complying with ASTM C 171.

a. Polyethylene film.

b. White burlap-polyethylene sheet.

3. Evaporation Control: Monomolecular film-forming compound (Eucobar by Euclid Chemical Co., or equivalent) applied to exposed concrete slab surfaces for temporary protection from rapid moisture loss.

4. Admixtures

a. Admixtures used shall not adversely affect the quality or strength characteristics of the concrete.

b. Admixtures shall contain not more that 0.1 percent chloride ions.

c. Use of admixtures for water reduction and set accelerating or retarding shall be in compliance with manufacturer's directions.

2.02 EQUIPMENT

A. The Contractors shall supply equipment and labor necessary for cast-in-place concrete placement.

B. Use buckets, chutes, hoppers, pumps, transit mix trucks, vibrators and other equipment that readily handles and places concrete of the specified slump.

PART 3 - EXECUTION

3.01 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the site as specified by manufacturer in original, unbroken, and labeled packages.

B. Store materials as specified by the manufacturer in a clean, dry, protected location and within the temperature range required by the manufacturer. Stored materials should be protected from direct sunlight.

C. Remove and replace material that cannot be applied within its stated shelf life.

D. Steel reinforcement shall be:

1. Stored in a manner that avoids rust, grease, oil, and other deleterious materials;

2. covered to reduce the accumulation of rust in stored outdoors for an extended period; and,

3. Inspected for rust prior to placing concrete. Heavy rust deposits shall be removed by sand blasting or wire brushing prior to placing concrete.

3.02 GENERAL

Coordinate the installation of joint materials, vapor retarder, and other related materials with placement of forms and reinforcing steel.

3.03 FORMS

A. Provide formwork suitable to support loads until concrete structure can support such loads. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation, and position. Maintain formwork construction tolerances and surface irregularities complying with the following ACI 347 limits for non-exposed surfaces.

B. Construct forms to sizes, shapes, lines, and dimensions shown and to obtain accurate alignment, location, grades, level, and plumb work in finished structures. Provide for openings, offsets, sink ages, keyways, recesses, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required. Use selected materials to obtain required finishes. Solidly butt joints and provide backup at joints to prevent cement paste from leaking.

C. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Kerf wood inserts for forming keyways, recesses, and the like for easy removal.

D. Cleaning and Tightening: Clean forms and adjacent surfaces to receive concrete Remove chips, wood, sawdust, dirt, or other debris just before placing concrete. Retighten forms and bracing before placing concrete, as required, to reduce leaks and maintain proper alignment.

3.04 PLACING REINFORCEMENT

A. Comply with Concrete Reinforcing Steel Institute's (CRSI) recommended practice for "Placing Reinforcing Bars," for details and methods of reinforcement placement and supports and as specified.

B. Clean reinforcement of loose rust and mills scale, earth, and other materials that may reduce or destroy bond with concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers.

D. Place reinforcement to maintain minimum coverages as indicated for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

F. Support slap reinforcement with bolsters, chairs or other approved methods. The use of lifting hooks to positions slab reinforcement shall be prohibited.

3.05 JOINTS

A. Construction Joints: Locate and install construction joints so they do not impair strength of the structure. Continue reinforcement across construction joints except where otherwise detailed.

B. Provide keyways at least 1.5 in. deep in construction joints in walls, between walls, footings and elsewhere as detailed. Bulkheads designed and accepted for this purpose may be used.

C. Water stops: Provide waterstops in construction joints as indicated on the Permit Drawings. Install water stops to form continuous diaphragm in each joint. Field-fabricate joints in waterstops according to manufacturer's printed instructions.

3.06 INSTALLING EMBEDDED ITEMS

A. Set and build into formwork anchorage devices and other embedded items required for other work that is attached to or supported by cast-in-place concrete. Use setting drawings, diagrams, instructions, and directions provided by suppliers of items to be attached.

B. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and contours in finished surfaces. Provide and secure units to support screed strips using strike-off templates or compacting-type screeds.

C. Place anchor bolts or other steel anchors in templates secured in place before placing concrete. Do not force anchorage in concrete after it has begun to set.

3.07 PREPARING FORM SURFACES

A. Coat contact surfaces of forms with an approved, nonresidual, water-based, form-coating compound before placing reinforcement.

B. Do not allow excess form-coating material to accumulate in forms or come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply according to manufacturer's instructions.

C. Coat steel forms with a nonstaining, rust-preventative material. Rust-stained steel formwork is not acceptable.

3.08 PROPORITONING AND DESIGNING MIXES

A. Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301. For the trial batch method, use an independent testing agency acceptable to Construction Manager for preparing and reporting proposed mix designs.

B. Submit written reports to Construction manager of each proposed mix for each class of concrete at least two weeks prior to start of Work. Do not begin concrete production until proposed mix designs have been reviewed and approved by ARE.

C. Concrete shall be of normal weight concrete with a water-cement ratio of less than 0.55 and a minimum 28-day compressive strength as follows:

1. Concrete boxes – 35 MPa (Grade C35); or

2. All other Site Concrete – 30 MPa (Grade C30).

D. Slump Limits: Proportion and design mixes to result in concrete slump at point of placement to a maximum of 150 mm.

E. Adjustment to Concrete Mixes: Mix design adjustments may be requested by the Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant, as accepted by CONSTRUCTION MANAGER. Laboratory test data for revised mix design and strength results must be submitted to and accepted by CONSTRUCTION MANAGER before using in Work.

F. If concrete is to be pumped then the mix design and slump shall be adequate for pumping.

G. Limit use of fly ash to not exceed 25 percent of cement content by weight.

3.09 CONCRETE MIXING

A. In general, ready-mixed concrete shall be provided in compliance with the referenced ACI standards and ASTM C 94, as modified herein.

B. All concrete shall be mixed in a transit mixer for a period of not less than 10 minutes at a peripheral drum speed of 60 rpm.

C. The discharge of concrete shall not be started more than 75 minutes after the introduction of mixing water. Complete placing of concrete within 90 minutes of the first introduction of water into the mix. Concrete older than 90 minutes shall be rejected. If transit time from the batch plant to the site precludes deposition within 90 minutes, the use of retarding admixtures may be authorized by Construction Manager.

D. No retempering of concrete shall be allowed. No concrete which has taken an initial set shall be used.

E. Water shall not be added to the mix after leaving the plant without the specific approval of Construction Manager. Water added without the approval of Construction Manager shall be cause for rejection of that load.

F. If approved by Construction Manager, water may be added provided that the slump does not exceed that specified.

3.10 CONCRETE PLACEMENT

A. Comply with ACI 304, "Guide for Measuring, Mixing, Transporting, and Placing Concrete," and as specified.

B. Deposit concrete continuously or in layers of such thickness that no new concrete will be placed on concrete that has hardened sufficiently to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified. Deposit concrete to avoid segregation at its final locations.

C. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers no deeper than 2 ft and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.

1. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete complying with ACI 309.

2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than the visible effectiveness of the machine. Place vibrators to rapidly penetrate placed layer and at least 0.6 in. into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mix to segregate.

3. Maintain a minimum of 2 working vibrators on the project during every concrete placement.

4. Maximum free fall of concrete shall be 5 ft. If the height exceeds 5 ft, then placement shall be made using a tremie.

D. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until completing placement of a panel or section.

1. Consolidate concrete during placement operations so that concrete is thoroughly worked around reinforcement, other embedded items and into

corners.

2. Bring slab surfaces to correct level with a straightedge and strike off. Use bull floats or derbies to smooth surface free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.

3. Maintain reinforcing in proper position on chairs during concrete placement.

E. Hot-Weather Placement: When hot weather conditions exist that would impair quality and strength of concrete, place concrete complying with ACI 305 and as specified.

1. Cool ingredients before mixing to maintain concrete temperature at time of placement to below 32 degrees C. Mixing water may be chilled or chopped ice may be used to control temperature, provided the water equivalent of ice is calculated to total the amount of mixing water.

2. Cover reinforcing steel with water-soaked burlap (e.g., gunny bags) if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedding in concrete.

3. Fog spray forms, reinforcing steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without puddles or dry areas.

4. Use water-reducing retarding admixture when required by high temperatures or other adverse placing conditions.

3.11 FINISHING FORMED SURFACES

A. Rough-Formed Finish: Provide a rough-formed finish on formed concrete surfaces not exposed to view in the finished Work or concealed by other construction. This is the concrete surface having texture imparted by form-facing material used, with tie holes and defective areas repaired and patched, and fins and other projections exceeding 6 mm in height rubbed down or chipped off.

B. Related Unformed Surfaces: At tops of walls, horizontal offsets, concrete slabs covering the concrete boxes, and similar unformed surfaces adjacent to formed surfaces, strike-off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.12 MONOLITHIC SLAB FINISHES

A. Float finish: Apply float finish to the concrete cover slabs on the concrete boxes as follows:

1. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating.

2. Begin floating, using float blades or float shoes only, when surface water has disappeared, or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both.

3. Consolidate surface with power-driven floats or by hand-floating if area is small or inaccessible to power units.

4. Finish surfaces such that the maximum departure from a 10 ft straightedge laid in contact with the floor is less than 0.2 in.

5. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.

B. Trowel Finish: Apply a trowel to slab surfaces of floor slab as follows.

1. After floating, begin first trowel-finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface.

2. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance, and finish surfaces such that the maximum departure from a 10 straightedge laid in contact with the floor is less than 0.4 in.

C. Nonslip Broom Finish: Apply a nonslip broom finish to exposed exterior concrete surfaces or other exterior slabs on grade. After float finishing, slightly roughen concrete surface by brooming with fiber-bristle broom. The depth of the broom asperities in the concrete surface should be approximately 0.1 in.

3.13 MISCELLANEOUS CONCRETE ITEMS

A. Filling in: Fill in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place, and cure concrete as specified to blend with in-place construction. Provide other miscellaneous concrete filling shown or

required to complete the work.

B. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on drawings. Set anchor bolts for machines and equipment to template at correct elevations, complying with diagrams or templates of manufacturer furnishing machines and equipment.

C. Protect all reinforcing steel and anchor bolts cast into concrete from contact with soil by 2 in. concrete unless otherwise indicated in the Permit Drawings.

D. Do not place loads on the concrete until concrete has cured for at least 7 days and reached minimum compressive strength of 4,000 psi.

3.14 CONCRETE CURING AND PROTECTION

A. For a period of 8 days following concrete placement, all forms and exposed concrete shall be kept sufficiently wet to reduce drying out of the concrete. Protect slabs and exposed corners of concrete from traffic or use that can damage them.

B. A curing compound may be used to reduce rapid moisture loss from the concrete. The compound shall be applied to freshly placed concrete after the concrete has hardened sufficiently. Apply the curing compound at the rate recommended by the manufacturer.

3.15 REMOVING FORMS

A. Formwork not supporting weight of concrete, such as sides of walls and similar parts of the work, maybe removed after curing for 36 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form-removal operations, and provided curing and protection operations are maintained.

3.16 REUSING FORMS

A. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material shall not be acceptable for exposed surfaces. Apply new form-coating compound as specified for new formwork.

B. When forms are extended for successive concrete placement, clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joint to reduce offsets.

3.17 CONCRETE SURFACE REPAIRS

Defects in exposed concrete work shall be repaired in accordance with ACI 332R, Chapter 11: Chip voids to a depth of at least 1 in. or deep enough to remove all loose material with the edges perpendicular to the surface and parallel to form markings. Fill voids, surface irregularities, chipped areas, etc. by patching, gunite, and/or rubbing, as directed. Duplicate the appearance of unpatched work. All concrete repair techniques shall be approved by Construction manager prior to implementation.

3.18 TOLERANCES

Pads and slabs shall be placed within 0.03 ft above or below the required elevation.

[END OF SECTION]

SECTION 03400

PRECAST CONCRETE

SECTION 03400

PRECAST CONCRETE

PART 1 - GENERAL

1.01 SCOPE

A. This Section covers miscellaneous precast concrete units for use as noted on the Construction Drawings.

1.02 RELATED SECTIONS AND PLANS

A. Construction Quality Assurance (CQA) Plan

B. Construction Drawings

1.03 REFERENCES

A. Latest version of American Society for Testing and Materials (ASTM) Standards:

1. ASTM A 36. Standard Specification for Carbon Structural Steel.
2. ASTM A 307. Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
3. ASTM C 443. Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
4. ASTM C 877. Standard Specification for External Sealing Bands for Concrete Pipe, Manholes, and Precast Box Sections.
5. ASTM C 920. Standard Specification for Elastomeric Joint Sealants.
6. ASTM C 990. Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants.

1.04 CONSTRUCTION QUALITY ASSURANCE REQUIREMENTS

A. Installation of precast concrete structures shall be monitored by the CQA Consultant.

1.05 SUBMITTALS

The information below shall be submitted to the Construction Manager at least 15 days prior to installation:

A. Product data and instruction for manufactured materials and products including manufacturer's certifications and laboratory test reports as provided by the manufacturer.

B. The Shop Drawings for precast concrete units shall be furnished by the precast concrete producer for approval by Construction Manager. These Shop Drawings shall show design, installation, and construction information in such detail as to enable the Construction Manager to determine the adequacy of the proposed units for the intended purpose. Details of stall reinforcement size and placement as well as supporting design calculations, if appropriate, shall be included. The Shop Drawings shall include a schedule, which shall list the size and type of precast concrete units at each location where they are to be used. The precast concrete units shall be produced in accordance with the Construction Manger approved shop drawings.

C. The Shop Drawings provided by precast manufacturer shall include calculations to demonstrate that the precast concrete units can support superimposed dead loads, live loads, surcharge, earth and hydrostatic lateral and vertical pressure as indicated on the Permit Drawings and as required for compliance with local governing code requirements.

1.06 AS-BUILT DOCUMENTATION

[Not Used]

1.07 CONSTRUCTION QUALITY CONTROL

A. General

1. The Contractor shall be responsible for performing the tests described in this Section and for performing such inspections as are deemed necessary by the contractor to demonstrate compliance with the requirements of this Section.

2. The Contractor shall provide sufficient personnel and supervision to monitor and document the work covered by this Section.

3. The Contractor shall provide reasonable use of on-site equipment and labor to assist Construction Manager and CQA Consultant in performing inspections and obtaining conformance samples for independent testing from stockpiles, borrow areas, and completed work. CQA Consultant will perform such inspections, monitoring, and testing in a timely manner so that it does not impede the progress of the Contractor. Construction

Manager will be responsible for coordinating inspection, testing, and monitoring requirements with the CQA Consultant.

B. Inspection

1. The precast manufacturer shall allow Construction Manager and the Contractor access to facilities, including materials storage areas, concrete product equipment, and concrete placement and curing facilities.

2. Precast units having dimensions greater than required will be rejected if the appearance of function of the structure is adversely affected or if larger dimensions interfere with other construction. Precast units having dimensions smaller than required will be rejected if the function of the structure or compatibility with adjacent units is adversely affected.

3. The Contractor shall remove and replace or repair precast concrete units that do not conform to specified requirements, including strength, tolerances, and finishes.

C. Testing

1. The Contractor shall submit to Construction Manager the compressive strength testing results provided by the preast manufacturer.

2. The Contractor shall conduct an audit of the precast manufacturer's facility to ensure that the manufacturing process is producing precast units that are of sufficient strength and generally suitable for use on this project.

D. Documentation

1. The Contractor shall provide to Construction Manager the precast manufacturer's testing, including the Project identification name and number, date, name of precast concrete manufacturer, name of concrete testing laboratory; identification letter name, and type of member or members represented by core tests; design compressive strength, compression breaking strength and type of break (corrected for length-diameter ratio), and direction of applied load to core with respect to horizontal plane of concrete as placed.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Manufactured Precast Concrete Units

1. Precast concrete units produced by a firm experienced in fabrication of precast concrete units similar to units required for this Work and that have a record of successful in-service performance, with sufficient production capacity to produce required units without causing a delay in work.

2. Furnish units that are free of voids or honeycomb, with straight true edges and surfaces.

3. Fabricate units of concrete materials that will provide a minimum 28-day compressive strength of 5,000 psi, unless otherwise specified or approved by the Construction Manager.

4. Adequately reinforce units to resist transportation and handling stresses.

5. Precast concrete manufacturer to provide design of all the precast units (as appropriate for the intended use) for the leading conditions shown on the Permit Drawings and as required for compliance with local governing code requirements.

6. Finishes

   a. Formed non-architectural surfaces: Surfaces cast against approved forms using industry practice in cleaning forms, designing concrete mixes, placing and curing concrete. Normal color variations, form joint marks, small surface holes caused by air bubbles, and minor chips and spalls will be tolerated but no major imperfections, honeycombs or other defects will be permitted.

   b. Unformed surfaces: Surfaces finished with a vibrating screed, or by hand with a float. Normal color variations, minor indentations, minor chips and spalls will be tolerated but no major imperfections, honeycombs, or other defects shall be permitted.

7. Patching and Repairs

   a. No repair is required to formed surfaces that are relatively free of air voids and honey combed areas, unless the surfaces are required by the design to be finished.

   b. Repairing Minor Defects – Defects that will not impair the functional use or expected life of a manufactured precast concrete product may

be repaired by a method that does not impair the product.

c. Repairing Honeycombed Areas – When honeycombed areas are to be repaired, loose material shall be removed and the areas cut back into essentially horizontal or vertical planes to a depth at which coarse aggregate particles break under chipping rather than being dislodged. Proprietary repair materials shall be used in accordance with the manufacturer's instructions. If a proprietary repair material is not used, the area shall be saturated with water and, immediately prior to repair, the area should be damp, but free of excess water. A cement-sand grout or an approved bonding agent shall be applied to the chipped surfaces, followed immediately by consolidating an appropriate repair material into the cavity.

d. Repairing Major Defects – Precast concrete products with major defects that impair the functional use or the expected life of the products shall be removed and replaced.

8. Inserts and Embedded Metal – All items embedded in concrete shall be of the type required for the intended task, and meet the following standards:

a. Structural steel plates, angles, etc: ASTM A36

b. Proprietary items: In accordance with manufacturer's published literature

c. Carbon steel bolts and studs: ASTM A 307, Grade A; carbon-steel, hex-head bolts and studs; carbon-steel nuts; and flat, unhardened steel washer

9. Joint Sealant and Joint Gaskets:

a. Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets: ASTM C 443

b. External Sealing Bands for Noncircular Sewer, Storm Drain, and Culvert Pipe: ASTM C 877

c. Joints for Concrete Pipe, Manholes, and Manufactured Box Sections Using Preformed Flexible Joint Sealants: ASTM C 990.

d. Specification for Elastomeric Joint Sealants: ASTM C 920